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PREDICTING HOW EARLY AND HOW MUCH YOUNG CHILDREN USE TELEVISION AND COMPUTERS: THE ROLE OF SOCIODEMOGRAPHIC, FAMILY, AND CHILD CHARACTERISTICS

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by

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PREDICTING HOW EARLY AND HOW MUCH YOUNG CHILDREN USE TELEVISION AND COMPUTERS: THE ROLE OF SOCIODEMOGRAPHIC, FAMILY, AND CHILD CHARACTERISTICS

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This study examined how early and how much young children (ages 6 months – 6 years) used television and computers. The roles that sociodemographic factors (parent education, income, and ethnicity), the family media ecology (availability of media, parental beliefs about media, regulation of media use, and the pervasiveness of television in the home), and child characteristics (age and gender) played in predicting these aspects of use were tested.

Event history analyses revealed that the incidence and prevalence of television viewing was higher than for computer use. Children whose parents were more educated used televisions and computers earlier than those whose parents had less education; those whose parents had negative beliefs about those media were least likely to start using them than were those whose parents did not have negative beliefs. Ethnicity was also an important predictor: Black children were more likely to start

watching television during the first 6 years of life than were non-Black children; Hispanic children were much less likely to have used a computer than were non-Hispanic children.

Structural equation models testing mediational processes among the predictors showed that income was primarily related to the availability and pervasiveness of television in the home, whereas parent education was associated with regulation. Positive beliefs about television predicted greater availability and pervasiveness of television, and the absence of rules about viewing. Overall, television viewing began earlier among children whose parents had more education, had rules about viewing, did not have television in the bedroom, and lived in a pervasive television environment. Lower parent education, positive parental beliefs about television, and exposure to pervasive television were linked to heavier viewing. Socioeconomic status and access were the primary predictors of how early and how much children used computers, especially among Black and Hispanic children. How early television-viewing and computer use began were not related to how much time children spent with these media.

The sociodemographic and family dynamics surrounding television use were more complicated than those for computers, suggesting that television has been firmly embedded into family life and complex processes shape its use in the home.

Table of Contents

List of Tables

List of Figures

STATEMENT OF THE PROBLEM

The role that media play in children's lives has brought forth much debate in both public and academic arenas for decades. The emergence of interactive media—spanning the range from computers, video games, and the Internet, to interactive toys, talking books, and wireless devices—promises to turn electronic media into an integral part of most children's lives. Expressions such as "the digital generation," "the wired generation," "electronic childhood," and "cyberkids" have been coined to describe the centrality of electronic media in the lives of children at the turn of the millennium and suggest that the children of today are growing up in a media environment that is very different from their predecessors'.

Research on media's place in children's lives, however, has yet to catch up with the extent of public and academic debate. With the degree of interest and concern on the impact of media on children – specifically, very young children – the body of research on which to base claims, recommendations, and policy decisions is surprisingly thin. The research that does exist focuses on television, and it suggests that young children (preschoolers and younger) watch—or at least, are exposed to—a significant amount of television from birth (Hollenbeck, 1978; Wright et al., 2001), and that infants are capable of imitating and learning from what they see on television (Hayne, Herbet, & Simcock, 2003; Meltzoff, 1988; Mumme & Fernald, 2002). The use of relatively new interactive media among the youngest children remains an

uncharted area of research, despite agreement among researchers on its importance (Lerner, Singer, & Wartella, 2001; Wartella, Lee, & Caplovitz, 2003).

Our fairly limited understanding of media in young children's lives has not precluded the American Academy of Pediatrics from making highly publicized recommendations, including those stating that television sets should be removed from children's bedrooms, children under the age of 2 should not watch any television, and those older than 2 limit their time with entertainment media to less than 2 hours of quality programs per day (American Academy of Pediatrics, Committee on Public Education, 2001). Although concerns about media effects on a young and vulnerable population are clearly warranted, these recommendations were based on analyses of media's influence—namely, television—on older children and adolescents rather than on the population that these specific recommendations address: very young children.

Historically, concerns have accompanied the advent of each new medium (Wartella & Jennings, 2000). Apprehensions about contemporary media arise at a time when many forms of media are being created and marketed with the youngest children in mind. Interactive products (e.g., *Barney Actimate*, *Little Touch LeapPad*), television programs (e.g., *Teletubbies*), videos (e.g., *Baby Einstein*), and computer software (e.g., *JumpStart Baby*, *BabyWow!*), claim to enhance infants' and toddlers' development through electronic learning, but these claims have little empirical basis. This surge of marketing and product pushing has not been accompanied by an empirical understanding of media in the lives of very young children (in this case,

referring to children 6 and under). A notable exception is the survey by the Kaiser Family Foundation that specifically examined media in the lives of children from birth to 6 (Rideout, Vandewater, & Wartella, 2003). A special issue of *Zero to Three* (Jordan & Fenichel, 2001) on babies, toddlers, and the media also examined this subject, but few other concerted efforts have emerged to understand media in the lives of those younger than school age.

Current discussions in the public and academic spheres on this issue rarely rise above speculation or educated guesses. Basic information such as when children first watch television or use a computer are absent from the literature. Learning how and when media first enter the lives of infants, toddlers, and preschoolers, and how these children spend time with media, are essential steps in developing informed guidelines for very young children's media use. Such an examination is both timely and important. Children's media landscape has changed substantially, even within the last 5 years; media products are being made for the youngest children—a phenomenon that was unheard of just a few years ago. Existing data do not focus on this population, and the information that does exist on young children's media use does not reflect recent changes in the media environment.

The purpose of this study is to fill this gap in our knowledge. It focuses on the antecedents of young children's media use and aims to describe when children first watch television and use a computer, and the role of sociodemographic, family, and child characteristics in predicting the onset of use. The study also examines how much

time young children spend with television and computers. While a substantial body of research exists on young children's television viewing, their computer use has been less thoroughly examined. The interplay of sociodemographic and family processes that influence the amount of use has yet to be explored; this study puts forth a process-based model linking sociodemographic, family, and child characteristics to children's media use.

This study is unique because it uses a nationally representative sample that targets the youngest children (ages 6 months to 6 years). It contains a wealth of information about young children's media environment, as well as how early and how much they use media. No research has emerged on how early children use television or the sociodemographic, family, and child characteristics that might influence the timing of use since basic descriptive analyses during the introduction of television in the 1950s (Schramm, Lyle, & Parker, 1961), and no one has examined these research questions with computer use in mind.

The next chapter addresses the relevant literature on children's media use. It begins with an overview of young children's media environment and the implications of media use for young children's development, and discusses the influences at the sociodemographic, family, and child levels that impinge upon the outcomes of interest: the age at which children first watch television and use computers, and the amount of time children spend with these media. This literature review focuses on young children (i.e., prior to formal school-entry), but research on older children was

included if it was informative. Most of the extant research centers on television; consequently, the literature review draws heavily from this existing work. Because of the paucity of research on how early children use electronic media, hypotheses regarding the age of first use are based on what is known about factors related to children's media use in general.

REVIEW OF THE LITERATURE

Recent data on American children's access to and use of electronic media reveal that young children live in media-rich homes. Among children ages 2 to 7, all had a television in the household and almost three-quarters had cable or satellite access. Computer technologies were less prevalent compared with television, but they nonetheless had a strong presence in many households: half (52%) had a video game system, and almost a third (62%) had a computer in the home (Roberts, Foehr, Rideout, & Brodie, 1999). More recent data indicated similar statistics for children 6 months to 6 years old; notably, a larger proportion of young children (73%) had computer access than before (Rideout et al., 2003).

Data from the Annenberg School of Public Policy's survey of media in the home also afforded researchers a closer look at media availability and use among toddlers (Jordan & Woodard, 2001). Although older children lived in homes with greater media saturation compared with younger children, electronic media were readily available to most young children. Analyses of a subsample of 145 families with children ages 2 to 3 showed that television was ubiquitous in these households, with most families owning more than one television set; 59% of the families owned a computer, 42% had a video game system, and 49% had Internet service, whereas only 35% subscribed to a newspaper (Jordan & Woodard, 2001). In short, for most young children, media are an integral part of their daily environment.

Media and Young Children's Development

The potential of electronic media to adversely affect children's development has often been a source of concern for parents, educators, pediatricians, and the public. Much of the concern centers on two lines of argument. One is that media use (namely, television viewing) has the possibility of throwing brain development out of balance. Television programs are primarily a visual format, and some have contended that excessive television viewing may interfere with the formation of essential neural connections in young children (Healy, 1990; Singer, 1980; Winn, 1985), leading to the underdevelopment of the left hemisphere that governs the processing of auditory language. As a result, young viewers are starved of the input that will allow them to develop into good readers (Healy, 1990; Singer, 1980). These assertions, although widely believed, have yet to be substantiated. Researchers have shown that what appears to be a passive activity actually involves active processing (Anderson & Lorch, 1983; Huston & Wright, 1983, 1989). These claims of passivity may be less valid for computer technologies, which are often considered "active" or "interactive" media. Nonetheless, some still contend that time with these media may cause impairments to children's social and physical development (Cordes & Miller, 2000; Healy, 1998).

A second concern is that media displaces time that children ought to be spending on developmentally important activities, such as play, spending time with parents, social interactions, and acquiring literacy skills (Cordes & Miller, 2000; Healy, 1990; 1998). The displacement hypothesis assumes a causal path where television

viewing takes time away from reading, but the cross-sectional and correlational nature of most studies on displacement make establishing causal influences impossible (Neuman, 1991). The theory further assumes that children have viable alternatives to media use and that they would be engaged in more educational activities if they were not using media. These assumptions remain to be verified. These apprehensions about media use pertain to characteristics of the medium rather than the content used, but a well established body of research has shown that content—although not the focus of this study—is paramount when considering the implications of media use for children's development (see Huston & Wright, 1997 and Lee & Huston, 2003, for reviews).

Foreground versus Background Media

Early studies on television viewing found that the television set was often left on even when no one was in the room (Schramm et al., 1961). This phenomenon continues to be common in young children's lives (Vandewater, Bickham, Lee, Cummings, Wartella, & Rideout, in press). Recently, researchers have distinguished between exposure to foreground versus background television when discussing television's impact on young children's development (Anderson & Evans, 2001; Anderson & Pempek, in press). Background television refers to programming that young children pay little attention to; they are generally not produced for child audiences and are thus not comprehensible to them (Anderson & Evans, 2001). By

contrast, young children attend to foreground television; it is designed for such an audience and is at least somewhat comprehensible (Anderson & Pempek, in press).

Evidence suggests that background television interferes with cognitive processing among adults by impinging on cognitive resources available for processing and comprehension (Armstrong & Chung, 2000; Armstrong & Greenberg, 1990), but for very young children, background media may impair cognition through different mechanisms. Researchers have found that ambient noise from inanimate sources—including the television being left on—can adversely affect infants' cognitive development (Wachs, 1986) and suggested several processes through which these effects might operate: Background noise may (a) cause infants to habituate to auditory stimulation and thus deprive them of an important source of environmental stimulation, (b) interfere with parents' verbal stimulation of infants and thus inhibit language development, (c) disrupt infants' exploration behavior by interfering with their ability to attend to appropriate stimuli in the environment, and (d) adversely affect infants' competence motivation because they develop a sense of helplessness in the face of persistent noise. Developmental tasks that involve language or sustained attention may be most strongly influenced by ambient background noise than tasks that do not (Wachs, 1986). The few studies that directly examined the impact of background television on very young children largely supported these contentions: Laboratory studies indicated that background television reduced young children's

play episodes as well as their attention during object play (Anderson & Pempeck, in press).

Given that the amount of ambient noise is a stable feature of the home environment (Wachs, 1986), that sheer exposure to ambient media may adversely affect infants' and toddlers' development, and that television viewing begins at an early age, the presence of background media warrants further attention among researchers.

Time Spent with Media

Starting in infancy, many children spend a part of their day using some form of electronic media. Researchers found that 18% of babies under a year old spent at least an hour watching television on a typical weekday; the percentage of children who watched at least an hour a day increases to 49% for toddlers (ages 12 to 23 months) and 69% for preschoolers (ages 24 to 35 months; Certain & Kahn, 2002). Time spent watching television increased by approximately an hour per year for the first 3 years of a child's life, and then leveled off (Certain & Kahn, 2002). In one of few studies that have considered television viewing as both a primary (i.e., the main activity) and secondary (i.e., watching television concurrently with other activities) activity, children ages birth to 2 watched almost 11 hours of television per week as a primary activity and about 2 hours as a secondary activity; preschoolers (ages 3 to 5) watched almost 14 hours per week as a primary activity, and almost 2 ½ hours as a secondary activity (Wright et al., 2001)

Estimates from national surveys revealed that toddlers (2- to 3-year-olds) spent about 4 hours 15 minutes in front of a screen on a typical day, with television dominating that screen time (2 ½ hours a day). Considerably less time was spent with other media, including books (46 minutes), computers (12 minutes), and video games (19 minutes; Jordan & Woodard, 2001). Similar estimates were found for 2- to 7-year-olds, who devoted 2 hours a day to television, 45 minutes to print, 11 minutes to computer use, 6 minutes to computer games, and 8 minutes to video games (Roberts et al., 1999). Comparisons of recent data suggest that young children are more likely to watch television than they did in the past (Anderson & Pempek, in press).

Age of First Use

Studies in the 1950s suggested that children typically experienced television for the first time at around age 2—usually as a result of "eavesdropping" on a program someone else in the family was watching—and that an estimated 14% of 2-year-olds had begun to watch television (Schramm et al., 1961). The first mass medium that children encountered was books: More young children were being read to than were watching television (Schramm et al., 1961). Since then, the advent of VCRs, cable and satellite television, DVD players, video games, computers, and the Internet has changed children's media environment and media use immeasurably. Among the current generation of young children, 87% of 0- to 3-year-olds have watched television; 69% watch television on a typical day (Rideout et al., 2003).

Researchers have made little progress in examining when children first use different forms of electronic media since the descriptive studies in the 1950s, despite the possible implications of early media use. Early experiences often initiate a trajectory for later development. Media use early in a child's life could set the stage for later use. For instance, using a medium early in life could be a precursor to becoming a heavy user of that medium in the future.

Although it is unclear whether such a process occurs, there is considerable evidence that young children's television viewing is stable over time, both in the short term and in the long term (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001; Certain & Kahn, 2002; Huston, Wright, Rice, Kerkman, & St. Peters, 1990; Tangney & Feshbach, 1988). The amount of television viewed when children were 2 to 3 years of age predicted viewing when they were school-aged, but television viewing prior to that—before the children were a year old—did not. This relation was independent of maternal race, income, marital status, and employment (Certain & Kahn, 2002). A study tracking two cohorts of children ages 3 to 5 found that both total time spent watching television and the kinds of programs viewed to be stable over a 2-year period, and that the stability of viewing between ages 3 and 5 was as high as that between ages 5 to 7 (Huston et al., 1990). This consistency in viewing was also found among older children (grades 4 to 6): Individual differences in the amount of television viewing were similar over a 3-year period, controlling for parental education and ethnicity (Tangney & Feshbach, 1988). What may be more remarkable

was the finding that the amount of television viewing remained modestly stable (r = .25) when measured long-term, from preschool to adolescence (Anderson et al., 2001). Taken together, these studies suggest that there is an early window of opportunity during which viewing habits are established, and this window seems to operate as early as the toddler and preschool years (but not as early as infancy).

The persistence of childhood television habits reflects both individual differences in viewing tastes and preferences that endure over time, as well as the constancy in the children's home environment, where adults and older siblings have habits of television viewing—which are themselves stable—to which children are exposed at a young age (Anderson et al., 2001; Huston et al., 1990). These findings indicated that television viewing habits were set early in life and the early experiences of children in the first years of their lives can have enduring consequences for the ways in which they use the medium (Huston et al., 1990; Huston & Wright, 1996).

Data on the stability in children's computer use have yet to emerge. Children are likely to use computers later than they do television because computers require some manual and cognitive sophistication to operate. In some cases, children may need to know how to read to be able to use most software, although voice operated systems may increasingly eradicate this need.

The age at which children first use computer technologies could have long-term implications for their development. Some believe that computer technologies will revolutionize education such that new forms of literacy—multimedia literacy and

technological literacy—have become key to education in the digital age (Kellner, 2002, Livingstone, 2002). Computer technologies are changing the nature of knowledge and the learning process, and the importance of being "technologically literate" is emphasized based on the belief that the creation and diffusion of knowledge—and therefore employment—will increasingly depend on screen-based media rather than print media (Livingstone, 2002). Digital skills that include both instrumental (operating hardware and software) and informational skills (being able to search, process, and use information from digital sources) will have important implications for one's educational and economic opportunities (Van Dijk & Hacker, 2003). Gaining facility with computers early in a child's life may provide the child with the skills and confidence to advance to more complex applications. Computer use may evolve toward use in more varied ways, accompanied by the mastery of more sophisticated hardware and software (Dutton, Rogers, & Jun, 1987), leading to an ability to participate in the technology that is becoming so central to the economy and society.

There is some evidence that school-aged children (8- to 10-year-olds) who used computers at home had more positive attitudes toward computers, which were transferred to their attitudes toward computing in the school environment (Mumtaz, 2001). This lends credence to the suggestion that home computer use can influence children's attitudes toward—and hence proficiency with—computers in school, and an early start in computing could familiarize children with computers and cultivate confidence in computing.

Knowing the age at which children first use electronic media is an important first step in understanding the roles that these media play in children's lives. Given the concerns over how deeply young children are immersed in media, it would be fruitful to know how early media use begins, and whether the likelihood of use increases steadily with age or if there is a particular age at which specific media enter children's lives. Differences in the age of first use is likely to emerge based on factors known to influence the adoption, diffusion, and use of media among households, namely sociodemographic and family factors.

As media become an increasing prominent aspect of childhood, they may enter children's lives at increasingly young ages; this could have repercussions on their neurological, cognitive, physical, and social development. Such speculations await empirical verification. In the meantime, it is both important and timely to establish baseline research with which to answer these questions, and to which subsequent cohorts of children can be compared.

The current generation of children is growing up surrounded by media, more so than any generation that preceded it. Media have become a significant part of the environmental context that influences development. Understanding media use among young children is a central part of the larger goal of understanding their development. The rest of this review focuses on examining how early and how much young children use two primary forms of electronic media—television and computers—within a

process-oriented, integrative framework that incorporates multiple predictive factors: sociodemographic factors, the family media ecology, and child characteristics.

Sociodemographic, Family, and Child Characteristics That Predict Children's Media Use

Electronic media are a complex aspect of the lives of children and their families, and factors operate on many levels to affect how early and how much they use media. Drawing from an ecological model that considers multiple levels of influence (Wright, St. Peters, & Huston, 1990), children's media use is examined in relation to sociodemographic, family, and child characteristics. For young children in particular, the family is considered a principal part of the process, in part because sociocultural practices are filtered through the family (Huston & Wright, 1996). This review is organized from the most distal (sociodemographic) to the most proximal (child characteristics) influences. Within each section, the literature on television and computers are reviewed.

Sociodemographic Characteristics

Children's experiences with media are filtered through the family, whose beliefs and behaviors are shaped in part by a broader societal context. The key socio-demographic factors known to influence children's media use—both directly and indirectly—are household income, parents' education, and ethnicity.

Household Income

Income has been consistently associated with children's media use. Often, its

correlation with such factors as parent education and ethnicity obscures its unique effects. The correlation between income and media use may have less to do with income per se than with other factors associated with income, such as parent education, work hours, the home environment, the availability of alternative activities, and so on. On its own, income probably has the strongest impact on access to media.

Television. With the saturation of television ownership, children had access to at least one television set regardless of income level (Rideout et al., 2003; Roberts, et al., 1999), although higher-income households owned more television sets than did lower-income households (Woodard & Gridina, 2000). Interestingly, however, more affluent households were less likely to have television sets in their children's bedrooms (Woodard & Gridina, 2000). Others have found similar disparities in the presence of bedroom television sets, wherein children from the highest income families were least likely to have a television set in the bedroom (Roberts, et al., 1999).

Income also predicted an overall decline in exposure to television among young children (2- to 7-year-olds): Children who lived in low-income areas watched approximately 45 minutes more television than did those who lived in high-income areas (Roberts, et al., 1999). These findings were echoed in the Annenberg survey (Woodard & Gridina, 2000), as well as in other studies (Gentile & Walsh, 2002).

The connection between how early in their lives children start to watch television and family income is unknown. Based on existing research, it appears that children in more affluent households, by virtue of access and the presence of multiple

television sets, may start to watch television at an earlier age than those in less affluent households.

Computers. Household income affects children's computer use primarily through the ability to provide access, particularly to newer or more costly systems. Although the price of computers has been steadily declining, computers remain a relatively expensive household purchase, especially when the cost of peripherals and software are factored in. As such, home computers remain out of reach for most children from less affluent households.

The reality of the digital divide has been well documented. Lower-income households had restricted access to computer technologies and the Internet compared with more affluent households (Becker, 2000; Newburger, 2001; Rathburn, West, & Hausken 2003; Roberts, et al., 1999; Wilson, Wallin, & Reiser, 2003; Woodard & Gridina, 2000). Research on the diffusion and adoption of home computers has consistently indicated that adopters were more likely to have higher income and education than were non-adopters (Atkin & LaRose, 1994; Dickerson & Gentry, 1983; Dutton et al., 1987). Children from higher-income families had more opportunity to benefit from informational resources in the home. The competencies considered important in the 21st century—information gathering, analytic skills, and graphical communication skills—may thus develop chiefly among the privileged (Becker, 2000).

The multifaceted nature of access. Some have predicted that the importance of income on the adoption and use of computers will be short-lived: As the price of

computers fall, the strength of the relation between income and adoption will weaken, and the diffusion of computer technology will level off (Atkin & LaRose, 1994; Dutton et al., 1987; Wilson et al., 2003). While these assertions might be true, the digital divide is more than simply a gap between the haves and have-nots. The socioeconomic gap in access is further compounded when one considers the *quality* of access in addition to access per se (Becker, 2000). Quality of access was defined in terms of the functionality of the computer: whether it had a hard drive, CD ROM drive, printer, modem, and a mouse. Socio-economic factors such as income, parent education, ethnicity, and parents' work-based experiences with a computer were strong predictors of the quality of home access (Becker, 2000). In fact, a large portion of the relation between SES and children's home computer use was accounted for by the quality of the computer and parents' computer use at work (Becker, 2000). The contention that computer hardware will be increasingly affordable is only partly correct: Computers become obsolete faster than any other medium and have to be continually updated, which involves the purchase of new hardware and software, as well as content and services (Van Dijk & Hacker, 2003). Inequalities in access, compounded by inequalities in computer functionality, serve to magnify the digital divide.

Parental Education

Many of the associations between income and children's media use also hold true for parental education and use. Researchers have found that when parent

education was statistically controlled, income often did not predict children's television viewing (Huston & Wright, 1996). Thus, differences in education often drive differences in income.

Television. Researchers have reliably found that children with more highly educated parents spent less time watching television. Parents with less education reported that their children (ages 2 to 17) spent more time each week watching television than children of parents with more education (Gentile & Walsh, 2002). Young children (ages 2 to 7) whose parents did not attend college also spent a greater proportion of their media time watching television than did those whose parents had at least some college education (Roberts, et al. 1999). Similarly, 3- to 17-year-olds who had at least one college educated parent watched less television than those who did not (Timmer, Eccles, & O'Brien, 1985). The relation between education and viewing was consistent across ethnicities: Lower levels of parental education predicted higher levels of television viewing among both European American and African American children (Bickham et al., 2003; Tangney & Feshbach, 1988).

Parent education was a better predictor of time spent watching television for younger children (ages 0 to 5) than it was for older children (ages 6 to 12; Bickham et al., 2003), suggesting that parental factors could have a particularly salient impact on young children's media use. As children become older, other influences such as peer groups and school entry become important. One study revealed that differences in time spent viewing television as a function of maternal education appeared early in a

child's life. They grew more evident as children got older such that by the time children were 4 years old, those with less well-educated mothers were watching 2 hours more of television a day than those with more well-educated mothers (Certain & Kahn, 2002). These disparities may level off once children enter school, but research suggests that differences in viewing habits endure well beyond early childhood (Anderson et al., 2001).

Parent education may also have some impact on how early children start watching television: Early studies indicated that children whose parents had little education (i.e., no more than grade-school) were more likely to watch television very early in their lives compared with those with more highly educated parents; overall, however, children of better educated parents used all media (television, radio, movies, and print) earlier (Schramm et al., 1961). Perhaps children with more highly-educated parents are exposed to a variety of experiences—including watching television—relatively early.

Compared with parents with less education, those who are well educated may have different opinions about media, be more aware of media's influence, and be more able to provide alternative activities for their children. Thus, children with well educated parents may watch less television, but watch it earlier, than those with less well-educated parents.

Computers. The associations between computer use and parent education mirror those between use and income (Newburger, 2001). Parent education

potentially influences children's computer access and use in several ways. Income predicts parents' ability to purchase resources (i.e., economic capital), whereas education is a form of human capital that is associated with how parents use those resources and their beliefs about which resources are important. To the extent that computer technologies are perceived as being central to children's future success, parents would invest more resources and effort in helping their children be proficient with them (Wilson et al., 2003). More education could strengthen such beliefs; it could also better equip parents to do so, as they would have a better understanding of computing, have more experience with the medium, and perceive it as being less complex (Becker, 2000; Dickerson & Gentry, 1983).

Analyses of computer adoption among adults indicated formal education to be the single variable most reliably related to the adoption of computing (Dutton et al., 1987). Children with college-educated parents were also more likely to have a computer in their bedroom than were those whose parents completed no more than high school (Roberts, et al., 1999). Even within computer users, however, children ages 8 to 18 whose parents completed college spent more time on every kind of computer activity (e.g., games, chat, email, schoolwork) than did those whose parents did not complete college (Roberts et al., 1999). Others found similar disparities in computing activities among children of different SES (Becker, 2000).

Parents with higher levels of education could have more prior experience with computers—an important predictor of adoption—particularly at their place of work

(Dickerson & Gentry, 1983). Parents who had computer experience at work appeared to help their children with many computer applications (Becker, 2000). Thus, children whose parents have more education are likely to be exposed to computer technologies earlier and spend more time with the medium than are those with less well-educated parents.

Ethnicity

Effects of socioeconomic factors such as income and education are difficult to interpret without considering ethnicity. Ethnicity can be an important moderator in children's media use.

Television. Researchers have documented differences among ethnic groups on the amount of television viewed: African Americans and Hispanic Americans watch more television than do European Americans (Bickham et al., 2003; Blosser, 1988; Roberts et al., 1999; Tangney & Feshbach, 1988). African American children watched 1½ to 2 times as much television as European American children (Roberts et al., 1999; Tangney & Feshbach, 1988). In general, Hispanic Americans watch less television than African Americans but more than European Americans (Blosser, 1988; Greenberg & Brand, 1994; Roberts et al., 1999). While differences in media use among ethnic groups may be confounded with differences in income and education levels, research has indicated the relation between ethnicity and television viewing to be independent of parents' education (Tangney & Feshbach, 1988) or income level (Greenberg & Dervin, 1970).

These findings suggest that ethnic differences in television viewing may be accounted for by factors other than SES, one of which is the function that television serves. Evidence suggests that African American and Hispanic American children use media to fulfill functions in their lives that are different from those of European American children. African American children use television to form their own ethnic identities, find out about those from other ethnic and social backgrounds (Huntemann & Morgan, 2001), and learn about conventions of social behavior (Greenberg & Brand, 1994). Hispanic American children use television as both a conduit for acculturation (Stilling, 1997) and a connection to their cultural roots (Subervi-Vélez & Necochea, 1990). These specific functions of television could cultivate attitudes and beliefs about the medium among ethnic minorities that differ from those of non-minority groups. For instance, compared with European Americans, African Americans believe that television is more real (Greenberg & Brand, 1994), find watching television more enjoyable (Albarran & Umphrey, 1993), and hold more favorable attitudes toward television (Huston et al., 1992). Therefore, individuals of different ethnicities may have different attitudes toward television that could subsequently influence viewing.

Computers. Ethnic-group differences are equally— if not more—pronounced for computer use as they are for television viewing. Surveys have consistently shown that African American and Hispanic American children of all ages were far less likely to have computer or Internet access than were White non-Hispanic and Asian/Pacific Islander children (Becker, 2000; Newburger, 2001; Rathburn et al., 2003). Differential

access may be explained by differences in socioeconomic status, but researchers have found that even among families with similar income and parent education levels, there remained a 10% lower level of access among most African American and Hispanic children compared with White non-Hispanic or Asian-American children (Becker, 2000).

Thus, socioeconomic factors cannot fully account for ethnic differences in children's computer access. Others have suggested psychosocial factors as barriers to adults' computer use (Stanley, 2003). These include beliefs that computer technology is irrelevant to their lives, discomfort and anxiety toward using computers, thinking of computers as luxuries for children or for those advanced in their professional careers, and not valuing educational success in their subculture. Many of these beliefs stem from a lack of exposure to computer technologies—either in one's job or among members of one's social circle (Stanley, 2003), and the lack of exposure is likely to be more widespread among those in minority groups.

Summary

Sociodemographic factors have both direct and indirect associations with how early and how much young children use media. Income can have a direct impact on the availability of media in the household, as can parental education. Education and ethnicity can impinge upon parents' beliefs about media. The impact of SES on children's media use is partially mediated by family context elaborated below.

Family Media Ecology

Young children's media use occurs almost exclusively in the home and the family is the core socializing force behind it. Their early exposure to media occurs largely through the choices made by other family members (Huston & Wright, 1996). Parents may influence children's television viewing experiences by coviewing television with them, modeling television use, guiding their children's media choices, and by making decisions about what programs to watch and when viewing occurs (St. Peters, Fitch, Huston, Wright, & Eakins, 1991).

Indeed, researchers have found that apart from demographic characteristics such as the child's age and gender, particular family characteristics were strong predictors of how much time children spent watching television. Chief among these were the family's television viewing patterns, including how much television parents watched, whether the television set was on most of the time, and whether family members were actually watching it when it was on (Timmer et al., 1985). Others have also found that the family culture surrounding television use was a more useful correlate of children's television viewing than was the availability of television (e.g., the number of television sets in the household or the presence of a television in the bedroom; Saelens et al., 2002).

Less is known about the relation between children's computer use and the family ecology surrounding computers, although there is some evidence that the nature or quality of children's computing activities at home is largely dependent on

parental support and encouragement, including supplying the necessary hardware and software, establishing clear purposes for using the computer, modeling computer use, and providing guidance on its use (Giacquinta, Bauer, & Levin, 1993).

The factors that capture the family's media ecology comprise attitudinal, structural, and behavioral features: parental beliefs about media, the availability of media in the home, parental regulation of media use, and the pervasiveness of media in the home.

Parental Beliefs about Media

Parents' beliefs about media's influence can indirectly affect their children's media use through avenues such as providing access, regulating media use, and creating a pervasive media environment in the home. Researchers have yet to understand the link between parents' beliefs about media and the pervasiveness of media, as well as that between beliefs and the provision of access. Of these associations, the one between parents' beliefs or concerns about media and the regulation of their children's media use has been the most thoroughly explored. As well, parents' attitudes toward television have been more well-documented compared with computers.

Television. When asked to rate their concerns about various media, most parents rated television as the most worrisome, followed by music, the Internet, and movies. Video and computer games elicited relatively little concern among parents (Woodard & Gridina, 2000). Parental concerns varied by their child's age: Parents of

preschool-aged children expressed more concern about television than did those of adolescents, whereas parents of preschoolers were less likely to be concerned about music, the Internet, and the movies than were parents of children in elementary school and adolescence (Woodard & Gridina, 2000). By contrast, an earlier survey found parents of preschoolers to hold a higher opinion about the quality of television programming for children compared with parents of older children, with most preschoolers' parents reporting that television has done more good than harm (Stanger & Gridina, 1999). Among all media, then, parents of young children were most concerned about television, possibly because their children spent the most time with it. Parents of preschoolers, however, may have a favorable opinion of the program selections available on television because most educational programs are targeted at preschool children.

Studies investigating parents' beliefs about television have unveiled mixed findings. In one study, mothers of 5- to 10-year-olds expressed ambivalence toward television, seeing it as both a source of education and information, and of bad habits. Often, parents appeared to think that much of television was innocuous, and that it was neither good nor bad for children (Wright et al., 1990). Others have found that mothers thought that television could offer learning experiences for their children, although very few of the programs their children viewed were in fact educational (Hess & Goldman, 1962).

Parents had different ways of addressing their concerns about media. One way was to promote alternative activities, including the use of other (e.g., print) media (Woodard & Gridina, 2000). Another—perhaps more direct— way in which parents addressed their concerns about media was to supervise their children's media use. Compared with parents who were less concerned about media, those were more concerned reported higher levels of supervision of their children's media use across the four media surveyed (television, music, video games, and the Internet). Television was more heavily supervised than the other media. For television, most parents reported using restrictive practices (i.e., forbidding particular content, turning off objectionable content, and restricting the amount of time with the medium) at least "sometimes" (Woodard & Gridina, 2000).

Parental attitudes toward television were not only related to levels of supervision, but also to the specific ways in which they mediated their children's use of the medium. Beliefs about negative effects of television were related to parents' use of restrictive (e.g., forbidding certain programs, setting viewing hours, specifying programs) and evaluative (e.g., explanations and discussions about the program) guidance, whereas beliefs about prosocial effects were related strongly to the use of evaluative guidance (Bybee, Robinson, & Turow, 1982). Another study with parents of children ages 1 to 17 showed that parents who held highly negative attitudes about television were more likely to use both restrictive (e.g., setting specific viewing hours, forbidding the viewing of certain shows, limit the amount of viewing) and instructive

(e.g., trying to help the child understand what he/she saw on TV, explain why characters did what they did) mediation than were those with less negative attitudes (Warren, Gerke, & Kelly, 2002). Parental attitudes toward television were more predictive of their use of restrictive mediation and instructive mediation than were other variables, including demographics and parental involvement (Warren et al., 2002).

Parental attitudes toward television were reliably related to their mediation styles. Four typologies of mediation styles emerged from one analysis: (a) optimists, who were high in positive mediation and low in negative mediation; (b) cynics, who were high in negative mediation and low in positive mediation; (c) nonmediatiors, who were low on both positive and negative mediation; and (d) selectives, who were high in both positive and negative mediation (Austin, Bolls, Fujioka, & Engelbertson, 1999). Optimists differed most drastically from cynics: The former expressed more confidence in television portrayals, were more likely to think that television was a good babysitter, and watched more primetime shows than did the latter; cynics were less likely to think of television as a good learning tool than were optimists (Austin et al., 1999). Thus, parents who were skeptical about television and who themselves consumed less primetime fare were more likely to counter (and less likely to endorse) television content, whereas the pattern was reversed for those with positive views of television.

Parental beliefs about television are thus associated with their children's television viewing in multifaceted ways: They are related to whether and how parents regulate television, and—although less thoroughly researched—how parents themselves provide access to and use television. What predicts these beliefs is unclear, although it is reasonable to assume that they might be associated with education level (proxy for parental values) and the child's age.

Computers. Compared with television, much less is known about parents' attitudes toward computers and the relations between those beliefs and regulation. Research on adults' adoption of computers showed that adopters were more interested in, and held more favorable attitudes toward, science and technology than did non-adopters (Dickerson & Gentry, 1983; Dutton et al., 1987), indicating that parents' attitudes toward science and technology could be a potential predictor of their children's computer use. Parental education would very likely be implicated in the formation of such attitudes.

Researchers have found computer ownership to be consistently related to having a school-aged child in the family, suggesting that parents believed that computing activities were important and were trying to provide computing opportunities for their children. Census data revealed that two-thirds of households with a school-aged child (6 to 17 years old) had a computer and 53% had Internet access, whereas among households without a school-aged child, only 45% had a computer and 37% had Internet access (Newburger, 2001). Similarly, households

with children under the age of 18 were more likely to have a computer than those without children (Wilson et al., 2003).

With a few exceptions (e.g., Giacquinta et al., 1993; Turow & Nir, 2000), researchers have rarely surveyed parents about their beliefs or attitudes toward computer technologies. There is evidence that parental attitudes were related to children's computing activities: Parents who had a low opinion of educational software had children who did little educational computing at home (Giacquinta et al., 1993). Little else is known about how parental beliefs about computer use are related to their children's computer use.

Parental beliefs are likely to operate similarly for both television and computer use: Children whose parents have positive beliefs about television and computers are likely to use them earlier and more than those whose parents do not have positive opinions about these media, but beliefs probably operate through their impact on other parental behaviors surrounding media use (e.g., regulation, providing access) rather than directly.

Availability of Media

Earlier in this review, it was established that electronic media are readily available in homes with young children (Jordan& Woodard, 2001; Newburger, 2001; Rideout et al., 2003; Roberts et al., 1999; Woodard & Gridina, 2000). Such availability can be expected to have a direct bearing on how much and how early children use media: Children who live in homes where media are easily available are likely to use

them at an earlier age and spend more time using media than are those in less media-rich homes .

Another facet of availability is the presence of media in children's bedrooms. Electronic media, including computers, have pervaded the bedrooms of many children, even young children. It is unclear how media end up in children's bedrooms—whether they were intentionally provided by parents, or whether they were placed there for other reasons (e.g., storage in homes with multiple sets). Many view the presence of electronic media in children's bedrooms with concern. Access to media in the privacy of the child's room can result in more time spent with these media, and possibly higher levels of solitary use and lower levels of parental regulation. It appears that prior to age 8, however, few children used electronic media in their bedrooms (Roberts et al., 1999).

Television. Among preschoolers, approximately a quarter had a television in their bedroom, with bedroom sets more prevalent among older age groups (Roberts, et al., 1999; Woodard & Gridina, 2000). Other surveys have reported similar statistics, with 20% of 2- to 7-year-olds having a television in their rooms (Gentile & Walsh, 2002). Among children under 6, television viewing was the most common media activity in the bedroom, with 20% of parents reporting that their child watched television in their own rooms the previous day (Rideout et al., 2003).

Researchers have found that children who had their own bedroom television set spent more time watching television than did those who did not (Atkin, Greenberg,

& Baldwin, 1991; Gentile & Walsh, 2002; Jordan & Woodard, 2001; Wiecha, Sobol, Peterson, & Gortmaker, 2001), be it among young children (Jordan & Woodard, 2001), older children (Atkin et al., 1991; Wiecha et al., 2001), or a broad age range (2- to 17-year-olds; Gentile & Walsh, 2002). Others have found small and inconsistent relations between increased television viewing and having a bedroom television set among young children (Saelens et al., 2002).

The availability of media in children's bedrooms—and in their homes in general—often reflects parental choices in providing these media, which in turn is in partly influenced by parental attitudes toward media. Parents with greater interest in electronic media would likely provide themselves and their children with a wide variety of options and opportunities for using media, and spend more time using media compared with parents who are less interested in media (Wright et al., 1990). Likewise, parents who believe that media can help their children's learning would supply greater access to media or regulate media less stringently than would parents without such beliefs.

Families whose children had media in the bedroom differed in their regulation and knowledge of media from those who did not. A study found that households in which adolescents had more personal electronic media had fewer rules about television viewing (amount of time, what kinds of shows, and how late the child is allowed to watch television) than did those with fewer of child-owned media (Lin & Atkin, 1989). Compared with children without televisions in their bedrooms, those

who had televisions in their rooms had lower family monitoring of the child's media use (parents' use of rating systems, discussions about television content, parental monitoring of media content); had parents who were less consistent in their rules for their children's media use; had families that were less knowledgeable about media, media rating systems, and media effects; and had families that seldom engaged in alternative activities to electronic media (Gentile & Walsh, 2002). It is unclear, however, whether the relative absence of regulation is a result of the inability to regulate children's media use when it occurs in the privacy of their rooms, or whether other factors – such as parental beliefs about media or parenting practices – give rise to the presence of bedroom media as well as the absence of regulation.

Computers. Compared with television, computers were much less prevalent in young children's bedrooms, with 4% of 2- to 4-year-olds having a bedroom computer (Roberts, et al., 1999). Less is known about the impact of having computers in young children's bedrooms. This is in part because few young children have or use them in their bedrooms: Only 3% of children (ages 6 months to 6 years) used the computer in their bedrooms (Rideout et al., 2003). As these media proliferate, however, they are likely to appear in children's rooms at younger ages, and their presence could become increasingly normative.

Parental Regulation of Media Use

The term regulation has been used in the literature to refer to a range of behaviors. Research on parental regulation of computer use is scarce and focuses on

the supervision of older children's Internet use (e.g., Turow & Nir, 2000); thus, the regulation literature is largely derived from television research. The correlational nature of most studies on regulation precludes conclusions about the causal relation between parental regulation and children's media use. Parents may control their children's use in response to poor media habits, or children's media use may develop as a result of parents' mediation (Kotler, Wright, & Huston, 2001). These reciprocal relations are particularly likely to operate among older children, who are more able to make choices about media use and have more autonomy compared with younger children. Among younger children, one might posit that their media consumption is at least in part due to parental regulation as they are less likely to react against regulation or be attracted to undesirable media content. Yet another possibility is that parents find little need to regulate young children's media use, whose media habits may be deemed acceptable (Kotler et al., 2001).

Television. Parents have the potential to shape their children's television viewing. Television was the most heavily regulated medium in most families (Woodard & Gridina, 2000). Research has generally indicated restrictive mediation (i.e., regulation or rule setting) to be negatively associated with the amount of television that children watch. For instance, an observational study of parents and young children's (kindergartners and first-graders) television viewing revealed that parental mediation rarely occurred among children who were heavy viewers (Desmond, Singer, & Singer, 1990). Young children (ages 3 to 6) who were heavy

television viewers or who watched more commercial programming had parents who were less likely to be concerned about the negative impact of television and who did not perceive much need to control their children's television use (Holman & Braithwaithe, 1982). Similarly, 3- and 5-year-olds whose parents were restrictive of their viewing (i.e., showed high levels of regulation and low levels of encouragement) watched less television compared to those whose parents used other mediation practices (St. Peters et al., 1990).

Analyses with other age groups revealed similar findings: Children whose parents frequently imposed limits on television (both the amount of time and content viewed) spent less time viewing than did those whose parents rarely limited television use (Kotler, 1999). Among middle-schoolers, viewing was higher among those who reported no parental limits on viewing than among those with parental limits (Wiecha et al., 2001).

Although no research exists on the impact of parent restriction on how early children begin to watch television, it is reasonable to speculate that children who are subject to few restrictions would watch television at an earlier age compared to those whose parents impose more restrictions.

Computers. Little is known about how parents regulate very young children's computer use. A national survey indicated that more than half (55%) of parents of 2- to 17-year-olds reported "always" or "often" limiting the amount of time their children could play computer and video games (Gentile & Walsh, 2002), but specific

analyses of limit setting on younger versus older children were not reported. Unlike with television, young children require a fair amount of parental help—ranging from using hardware and software, to reading print onscreen—to operate computers, so computer use may occur largely in the presence of parents or older family members. Parents often make decisions (including purchasing decisions) about the types of software their children are allowed to use or the activities they are allowed to engage in. Thus, regulation with regard to computer use may not be as prevalent as regulation of television viewing. When it occurs, however, one would expect regulation to be negatively related to children's computer use.

Pervasiveness of Media in the Home

The ways in which parents and other adults in the family use media shape the media environment in the home, which in turn can influence children's media use. The extent to which media saturates home life, usually as a result of adults' media use, can have implications for how much and how early children use media.

Television. Research has shown that, across a broad range of ages, children whose parents watched more television were themselves heavy viewers of television (Desmond, Singer, Singer, Calam, & Colimore, 1985; Gross & Walsh, 1980; Heeter et al., 1988; Holman & Braithwaite, 1982; Jordan & Woodard, 2001; Woodard & Gridina, 2000). Parental viewing was also associated with the availability of television sets in children's bedroom: Children whose parents watched an hour or less of television per day were less likely to have a bedroom television set (39%) than were those whose

parents watched television more than 2 hours a day (56%; Woodard & Gridina, 2000). Parents' own viewing and their provision of a bedroom set for their child likely arise out of a common cause, such as enjoyment of television or having positive beliefs about television.

Most of the research on the relation between parent and children's media use is correlational; it is possible that children influence parents' viewing rather than the other way around. Researchers have failed to confirm this notion, however: Findings were consistent with parental influence on children's viewing rather than the reverse. A careful analysis of parents' and young children's (3- and 5-year-olds) television viewing revealed that children's viewing of general-audience programs occurred largely with parents, and this coviewing of general-audience programs was predicted by the parents' viewing habits but not from the child's individual viewing habits (St. Peters et al., 1991). Parent viewing predicted coviewing better than did child viewing, and this was particularly true for older than for younger children, despite the fact that older children coviewed television less frequently with their parents than did younger children. This pattern suggested that when coviewing occurred, parents were the ones that selected the programs, and that children may be gradually adopting their parents' program preferences (St. Peters et al., 1991). Thus, the viewing environment that parents create—in terms of total amount as well as content choices –- can be an important determinant of young children's exposure to television.

A growing body of evidence indicates that television provides a constant background in the lives of many children. An early study of elementary school children revealed that, not surprisingly, those who lived in a constant television environment watched more television than those who did not (Medrich, 1979). In a more recent survey, over 40% of respondents reported that the television in their homes was on most of the time regardless of whether anyone was watching it, and more than 60% indicated that the television was usually on during meals (Roberts et al., 1999). Older children were more likely to experience constant television than were younger children (Roberts et al., 1999), but even so, 35% of homes with very young children (ages 6 and under) have the television set on "most" or "all of the time", and children in these homes watched more television than children not living in such households (Vandewater et al., in press).

Others found that 6-year-olds who watched television during more meals spent more time watching television overall than did those who consumed fewer meals in the presence of television, and watching television during meals predicted more television viewing 6 years later (Saelens et al., 2002). The likelihood of constant television was inversely related to income and parent education (Medrich, 1979; Roberts et al., 1999) and positively related to favorable attitudes about television (Vandwater et al., in press). Such features as the constant presence of television and having meals while watching television reflect a family culture that is permissive or encouraging of television viewing (Saelens et al., 2002). Children in these households

are likely to spend more time watching television and be exposed to television at a younger age than those who do not live in such households.

Computers. There has been little research on how parents' computer use influences their children's use. Research showed that parents' experience with computers in their workplace was an important predictor of children's access to computers, and this relation is explained in part by parents' ability to help their children with computer applications (Becker, 2000). Computers are not subject to being the background to family life the way televisions can be.

Summary

The family media ecology is an important, multifaceted aspect of children's media use. Parents' beliefs about media can manifest themselves through a range of behaviors – making media available in the home, regulating their children's media use, and creating a pervasive media environment. These characteristics can jointly influence children's media use. Although it is unclear what predicts these beliefs, it is reasonable to speculate that they are affected by education level and factors such as the child's age.

Child Characteristics

Child characteristics—namely, age and gender—have direct and indirect effects on how much and how early children use media. The availability of programs on both television and computers varies for boys and girls and for children of different ages. Developmental capabilities are key considerations in a child's ability to use or

understand media content. Age and gender can also indirectly influence use through factors such as parental beliefs about media and regulation.

Age

Television. Television viewing is known to start in infancy, but there is little reliable information about very young children's television use. Data from the Panel Study of Income Dynamics' Child Development Supplement showed that the youngest children (ages birth to 2) spent significantly less time watching television as a primary activity compared with three older age groups (ages 3 to 5, 6 to 8, and 9 to 12). As a secondary activity, however, younger children (0- to 2-year-olds and 3- to 5-year-olds) spent more time watching television than did older children (Wright et al., 2001), indicating that viewing (or exposure) occurs concurrently with other activities. Another study found that preschoolers (ages 2 to 4) watched television as a primary activity for about 14 hours a week. For 2- year-olds, television was a secondary activity for a further 12 hours a week; their total viewing thus totaled over 26 hours a week. Four-year-olds spent about 8 hours a week watching television as a secondary activity; their viewing thus added up to 22 ½ hours a week (Huston, Wright, Marquis, & Green, 1999).

Age-based changes in viewing can be traced in part to cognitive developmental changes. With age, children moved from watching child audience programs that were relatively redundant and had simpler plots to those that were less redundant and required them to integrate plots over a longer time period (Huston et

al., 1990). Thus, children seemed to be choosing programs that fit with their ability to understand and interpret content. Researchers have shown that program comprehensibility is a main determinant of young children's attention to television and visual attention increases considerably during the preschool years, suggesting that television programs become increasingly comprehensible due to the child's acquisition of cognitive and language skills (Anderson, Lorch, Field, Collins, & Nathan, 1986).

Although developmental changes in cognitive abilities and interests were associated with children's viewing, they do not fully account for individual differences in viewing, which are largely a result of external factors such as parental choices (Huston et al., 1990) and regulation (Kotler, 1999). Researchers have generally found that across different forms of mediation (rule setting, restrictive mediation, encouragement, and coviewing), young children were subject to more regulation of their television viewing than were older children (Atkin et al., 1991; Bybee et al., 1982; Gross & Walsh, 1980; Lin & Atkin, 1989, Roberts et al., 1999; St. Peters et al., 1991), perhaps because parents believe that younger children are more vulnerable to influences from television (Atkin et al., 1991). Others have corroborated this notion: Parents of younger children were more likely to hold highly negative attitudes about television effects on children than were those of older children, and parents of young children (ages 1 to 6) had the most concerns about their children's viewing, followed by parents of older children (ages 7 to 12) and adolescents (Warren et al., 2002). The relation between the child's age and parental mediation could also reflect changing

levels of parental involvement in children's lives (Warren et al., 2002), or the relative ease of controlling young children's media use (Atkin et al., 1991).

Computers. Researchers have yet to focus on the processes that may underlie developmental changes in use. It has been well documented that older children spend more time with computers than do younger children (Becker, 2000; Roberts et al., 1999; Woodard & Gridina, 2000). The relative complexity of computer hardware requires some dexterity to manipulate, and many forms of computer activities (e.g., playing games or visiting websites) require literacy. Although hardware and software exist to facilitate young children's ability to use computers (e.g., keyboard toppers, voice-driven software programs), they have yet to be widely used. Thus, in additional to developmental considerations, the features of computers may hinder how early and how much young children can use them.

How parents regulate computer use among children of different ages is unclear. Because young children's mastery of the computer necessitates greater adult involvement compared with television, parents may not set as many rules about computer use because they are often using the computer with their children.

Compared with television, computer use is expected to be more prevalent and begin at a later age. As computer technologies continue to pervade the lives of children, and as the technologies continue to evolve rapidly, cohort differences could emerge such that substantial differences in use (both in amount and age of first use) are apparent between children born only a few years apart.

Gender

Television. Overall, researchers have found that boys are heavier users of electronic media than girls. On average, boys watched more television than did girls regardless of age (Desmond et al., 1985; Huston et al., 1990; Roberts et al., 1999; Wiecha et al., 2001). Others have found that boys and girls (ages 3 to 11) watched equivalent amounts of television on weekdays, but girls spent less time viewing than boys did on weekends (Timmer et al., 1985). The difference in time spent could be partly attributed to program content, with boys favoring masculine content and form, cartoons, action-adventure programs, and sports (Alvarez, Huston, Wright, & Kerkman, 1988)—genres that are prevalent in commercial programming. Other studies have failed to uncover gender differences in viewing (Huston et al., 1999; Ridley-Johnson, Chance, & Cooper, 1984; Wright et al., 2001); and still others indicated that among the youngest children, girls spent more time with television than boys did (Jordan & Woodard, 2001).

There is some evidence that parents regulate boys' and girls' media use differently; this difference could also partially explain gender differences in viewing. Parents tried to exercise more influence over girls' viewing than boys', reported setting more rules about television viewing for girls than for boys, were less likely to allow girls to watch programs with adult content, and made decisions about when the television set was on and what to watch more for girls than for boys (Gross & Walsh,

1980). Others confirmed this finding: Across ages (from birth to 12 years old), girls received more regulation on their viewing than did boys (Kotler, 1999).

Computers. Little information exists regarding gender differences in young children's computer use, although gender gaps in gaming—the most common computer-based activity—has been well established (see Wartella, O'Keefe, & Scantlin, 2000, for a review). This disparity between the genders is largely a result of the differential appeal of interactive games to boys and girls. Although computer games have been rated as being more girl-friendly than console games, few girl-friendly games existed overall (Children Now, 2001). Researchers have long demonstrated that girls' game preferences are distinct from those of boys. The violence and competitiveness that pervade interactive games held little appeal for girls, who preferred puzzles, spatial relation, and educational games. Gender differences were also apparent at a young age in preferences for multimedia interfaces (Passig & Levin, 2000). In their evaluation of an interactive storybook, kindergarten girls emphasized the importance of writing, colors, drawings, and the ability to get help from the computer, whereas boys valued control over the computer and movements onscreen. Thus, most computer programs were not created with girls' preferences in mind; rather, the traditionally male emphasis on control and navigation are key features of most games and are more attractive to boys (Passig & Levin, 2000).

Beyond the gaming domain, however, the gender gap in most other computer applications has narrowed (Wartella et al., 2002). Recent surveys found no gender

differences in overall computer use, although the gender difference is gaming has persisted (Becker, 2000; Woodard & Gridina, 2000). There is little empirical research on gender gaps in computer use with very young children.

Summary

Two important child-level factors that have direct and indirect relations with media use are age and gender. The availability or appeal of programs largely favors boys; age-based cognitive changes affect how much media children use. Child characteristics also affect use via contributions to parental beliefs about media (with parents of younger children having less positive views of media than those of older children) and parental regulation (with girls and younger children receiving more regulation than boys and older children).

Focus of the Present Study

Using data from the Kaiser Family Foundation's survey of children ages 6 months to 6 years (Rideout et al., 2003), the specific goals of this study are to investigate (a) when children first use television and computers; (b) the socio-demographic, family, and child characteristics that predict differences in how early children use television and computers; (c) the mediational processes that underlie the sociodemographic, family, and child factors that predict how early children use television and computers; (d) the mediational processes that underlie the socio-demographic, family, and child factors that predict how much children use television

and computers; and (e) whether early use of media predicts heavy use later in childhood.

Drawing on past research, a process-based model linking sociodemographic, family, and child characteristics to children's media use is proposed. These processes are outlined in Figure 1. Because of the exploratory nature of the model, both direct and indirect relations between predictors and dependent variables have been included. The proposed model begins with the exogenous variables parent education, household income, and ethnicity. They exert have both direct and indirect relations with how early and how much children use media; indirect relations operate through the family media ecology.

Ethnicity has direct and indirect links to children's media use. The indirect association with ethnicity works primarily through its relations with beliefs about media. Socioeconomic resources—parent education and income—also lay the foundation for family processes that predict how much and how early children use media. The relation between parent education and children's media use is mediated by several mechanisms: Education affects beliefs about whether media are beneficial or detrimental to children's learning. These beliefs in turn predict whether parents set rules regarding the use of media, which directly contributes to how early and how much children use media. Parental beliefs are also associated with the availability and the pervasiveness of media in the home: Parents with more positive attitudes toward media would be more likely to provide access to media, impose little or no regulation

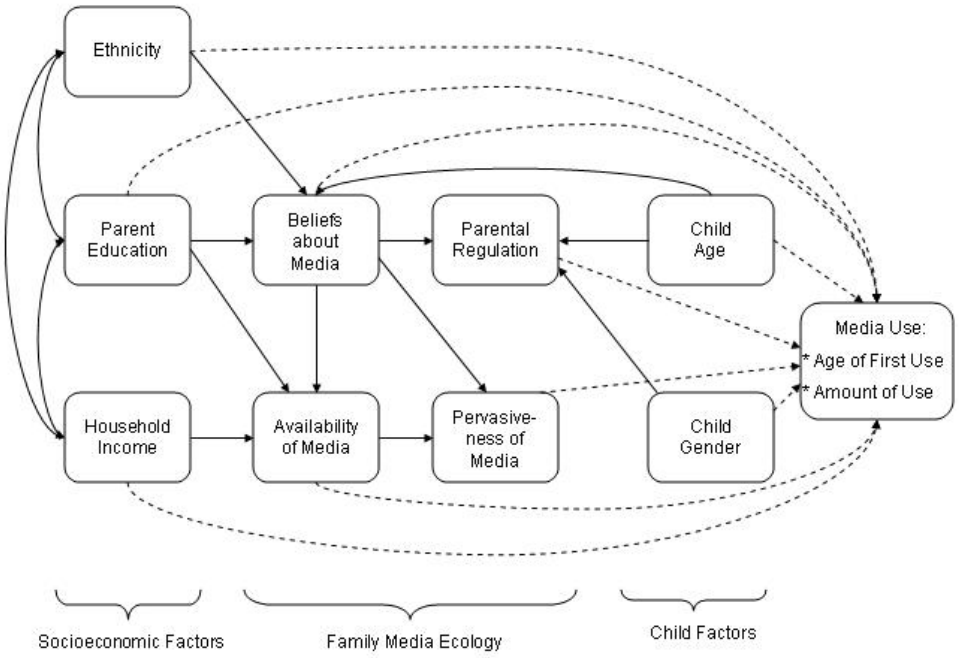


Figure 1. Conceptual model predicting how early and how much young children use electronic media. Direct relations between predictors and dependent variables are represented by dashed lines and mediated relations are represented by solid lines.

on their children's media use, and create (or allow) a pervasive media environment (e.g., leaving the television on in the background). These three variables—availability, regulation, and pervasiveness of media—are directly related to children's media use. The availability of media also contributes directly to a pervasive media environment, which increases the likelihood that children will spend more time with media and start using them at a younger age.

Household income primarily impinges on media use through the provision of access: Children from higher-income households would have more media available to them than would those from less affluent families. As outlined in the literature review, direct relations may exist between media use and parent education, income, ethnicity, availability, and beliefs about media.

Child-level factors—age and gender—have direct effects on media use because preferences and the availability of programs differ for these groups. Indirect effects also operate through parental regulation and beliefs about media. Parents of children of different ages or gender may have different concerns—and thus hold different beliefs about—media. Because age and ethnicity may moderate the relations depicted, analyses will test the empirical adequacy of the postulated model for children of different age and ethnic groups.

METHOD

The survey was designed to address very young children's media use and was planned in consultation with media experts convened by the Kaiser Family Foundation and the University of Texas at Austin's Children's Digital Media Center (CDMC). After the pretesting the questionnaire, the data were collected through telephone interviews by Princeton Data Source from April 11 to June 9, 2003.

Sample

The total sample comprised 1,065 parents of children ages 6 months to 6 years old. Participants were selected by random-digit telephone dialing and completed a telephone survey. Interviewers made up to ten attempts to contact each sampled telephone number. Among the calls, a request was made for an interview in 85% of the working numbers contacted, 56% of those contacted initially agreed to the interview, and 83% of the initially cooperating and eligible interviews were completed, yielding a response rate of 39.5%.

Calls were staggered over times of day and days of the week. For each household that was eligible, interviewers asked to speak with the parent who spent the most time with the target child. If neither parent spent more time with the child, one was randomly chosen for the interview. The sample was weighted to yield nationally representative estimates in statistical analyses. Sample weights were recalibrated such that the weighted sample size equaled the unweighted sample size. Analyses were conducted on subsamples that provided complete information on the

variables of interest. Each subsample was checked for multivariate normality using the Mahalanobis distance; cases with excessively large values were deleted. Details of the analysis samples will be described later.

Measures

Time Spent Using Television and Computers

Respondents reported the amount of time their children spent with television and computers the previous day. If the previous day was atypical, parents were asked to think about the last day they followed their typical routine. The response categories were 5 minutes, 15 minutes, 30 minutes, 45 minutes, 1 hour, 1½ hours and up, in half-hour increments. Time spent using computers was a sum of time spent playing computer games and time spent using a computer for something other than games. Because both variables were highly skewed or kurtotic (television minutes: skewness = 1.88, kurtosis = 5.65; computer minutes: skewness = 6.50, kurtosis = 61.75), their log-transformations were used in all statistical analyses (log of television minutes: skewness = -.69, kurtosis = -1.19; log of computer minutes: skewness = 1.97, kurtosis = 2.19).

Age of First Use

Parents were asked a series of questions about whether their child had ever used or performed specific actions with media (e.g., watched television, turned on the television by themselves, asked to watch a specific video, used a computer while sitting on a parent's lap, visited children's websites, etc.) and if so, were asked to

indicate what age their child first did so. The response categories ranged from *less than 6 months, 6 to 11 months, 1 year,* and up in 1-year increments up to 6 years, yielding an 8-point measure. The present analyses focused on the age at which the child first watched television and used a computer. *Age of first television use* was derived from a question asked specifically about the age that the child first watched television. *Age of first computer use* was computed from the *earlier* of two variables: age when the child first used a computer while sitting on a parent's lap and age when the child first used a computer without sitting on a parent's lap.

Sociodemographic Variables

Household Income

Respondents reported on their household income, measured on a scale ranging from 1 (*less than $10,000*) to 7 (*$100,000 or more*).

Parent Education

Parent's education was measured using a 7-point scale ranging from 1 (*none, or grades 1-8*) to 7 (*post-graduate training or professional schooling after college*).

Ethnicity

Information about the respondent's ethnicity was collected. Two indicator variables denoted whether the respondent was Black (non-Hispanic) or Hispanic. White (non-Hispanic), Asians, and "other" ethnicities served as the reference group. For ease of reporting, children with a Black, non-Hispanic parent will be referred to as

"Black," those with a Hispanic parent will be referred to as "Hispanic," and those whose parent was White, Asian, or "other" will be collectively referred to as "White."

Family Media Ecology Variables

Parental Beliefs about Media

To ascertain parents' beliefs about television and computers, they were asked the following, "In general, do you think watching TV (or using a computer) mostly helps or mostly hurts children's learning— or doesn't have much effect either way?" Responses were coded from 1 to 3 such that higher scores indicated more positive beliefs about each medium.

Availability of Media

The availability of television in the home was measured by two variables: the number of television sets in the home and the presence of a television set in the child's bedroom (regardless of whether it received any channels or was only used for videos). Computer availability was measured by the number of computers in the home. Because few children had a computer in the bedroom, this measure could not be included in analyses.

Parental Regulation of Media

Parental regulation (or rule setting) of media was measured with a dichotomous variable indicating whether the parent had rules about the amount of time their child could spend watching television or using the computer.

Pervasiveness of Television

The pervasiveness of television in the home was measured with two indicators: *constant television*: the extent to which the television was on in the home even when no one was watching it; and *television during meals*: the frequency with which the television is on when the family is eating meals. Both measures ranged from 1 (*never*) to 6 (*always*). Because no equivalent questions were asked about computer use, the pervasiveness of computers in the home could not be ascertained.

Child Variables

Age

Parents reported the child's age, which ranged from less than 1 to 6 years.

Gender

Child gender was dummy coded with boys as the reference group.

Only Child

Because studies have indicated that birth order can be an important correlate with children's television viewing (Pinon, Huston, & Wright, 1989), *being an only child* in the household was used as a covariate (with 1 indicating an only child and 0 indicating the presence of siblings).

Analysis Plan

The purposes of this study are to examine the when television and computer use begin, the processes that underlie how early and how much children use television and computers, and whether early use is associated with heavy use later in childhood.

An alpha level of .05 was used in all analyses. The analyses most appropriate for answering each research question vary and are outlined below.

Examining When Media Use Began: Event History Analyses

Age of first use can be conceptualized as the length of time that passes before the occurrence of an event—in this case, a child watching television or using a computer. A particular feature of such data is that some participants will never experience the target event before the end of data collection. These observations are said to be censored. Participants with censored data provide information about event occurrence or more specifically, information about nonoccurrence. The researcher cannot assume that none of these individuals will ever experience the event, however (Singer & Willet, 1993). Had the data collection been extended to include older children, incidents of first use would almost certainly increase.

Such data are not suited for standard statistical procedures like multiple regression (Allison, 1984). Alternative ways of handling such data are unsatisfactory. For instance, eliminating individuals who have not yet experienced the event from analyses negatively biases the distribution of time before an event (Willet & Singer, 1991). Dichotomizing the dependent variable into use versus non-use is arbitrary and wastes information; it is arbitrary because there is nothing theoretically important about the 6-year mark except for the decision to sample 0- to 6-year-olds, and one could as easily have decided on a 3- or 5-year cutoff; information is wasted because variation on either side of that cutoff is disregarded (Allison, 1984).

The technique best suited to analyzing such data is event history analysis, also known as survival analysis. Event history analysis incorporates both censored and uncensored cases in an analysis. Duration is not examined directly; rather, a logit transformation of *hazard* is used as a dependent variable. Hazard is defined as the probability that an event will occur at a particular time to a particular individual, given that the individual has not experienced the event at that time (Allison, 1984). *Hazard models* are used to model the associations between hazard and specific predictors. When time is measured discretely—as it is in these analyses, in terms of age in years—model parameters can be estimated using standard log-linear or logistic regression methods (Singer & Willet, 1991; Willet & Singer, 1991).

In this study, hazard measures the probability that a child started watching television or using a computer in any particular year given that he or she had not used the medium in any previous year. The conditionality inherent in the hazard rate ensures that it measures the probability of use in each year among those who have not yet used the medium (Singer, Fuller, Keiley, & Wolf, 1998). The samples were not divided into age categories for analysis because children of different ages have been exposed to probabilities of use (or are "at risk" for use) for different periods of time. Event history analysis accounts for these differential periods of risk. Further, splitting up the age groups results in time periods where no use occurred and hazard could not be estimated.

For the proposed analyses, discrete-time event history analysis was used to describe the average duration before a child watched television or used a computer and to determine the factors that predict variation around the duration. The association between the hazard rate and predictors was examined by fitting a sequence of discrete-time models (using logit regression) that linked the probability of using television or computers to sociodemographic, family, and child characteristics.

Analysis Samples

Analyses were conducted on children of all ages for whom there was available data on all variables *except* regulation (i.e., rule-setting) because parents whose children had never used television or computers were not asked about regulation with regard to these media. Excluding these children from investigation would systematically eliminate children who had never used television or computers but who in fact contribute information about the distribution of time before the onset of use. The resulting analyses would thus not fully represent the available data.

When studying event histories, the unit of analysis is not the person but the person-period. The data contain a separate record for each time period when an individual is "at risk" for experiencing an event. For instance, a 4-year-old who has never watched television contributes four records—four person-years— to the data: one for each year the child had some probability of watching television; this child is censored in the fourth year because viewing never occurred. If a 4-year-old first watched television at age 2, then the child contributes 2 person-years to the data. The

person-year dataset for television viewing contained 1,661 observations representing 816 children and the data for computer use contained 2,903 observations representing 834 children.

Bias analyses. Bias analyses were conducted to assess differences between children who were included in the analysis samples from those who were excluded. Compared with children not in the *television* sample, those in the sample had parents with higher education, $t(1058) = 3.06$, $p < .01$; had more televisions in the home, $t(383) = 2.53$, $p < .05$; watched more television, $t(358) = -2.38$, $p < .05$; were less likely to be Hispanic, $\chi^2(1) = 6.64$, $p < .01$; and were more likely to be an only child, $\chi^2(1) = 4.31$, $p < .05$. The two groups did not differ on age, gender, the likelihood of being Black, household income, exposure to constant television, having the television on during meals, having a television in the bedroom, and parental beliefs about television.

Compared with children excluded from the *computer* sample, those who were included had parents with more education, $t(1058) = 4.33$, $p < .01$; higher income, $t(969) = 3.42$, $p < .01$; had more computers at home, $t(443) = 5.08$, $p < .01$; spent more time using a computer, $t(399) = 2.89$, $p < .01$; were less likely to be Black or Hispanic, $\chi^2(1) = 39.72$, $p < .01$; and were more likely to be girls, $\chi^2(1) = 5.42$, $p < .05$. The two groups were similar in age, likelihood of being an only child, and parental beliefs about computers.

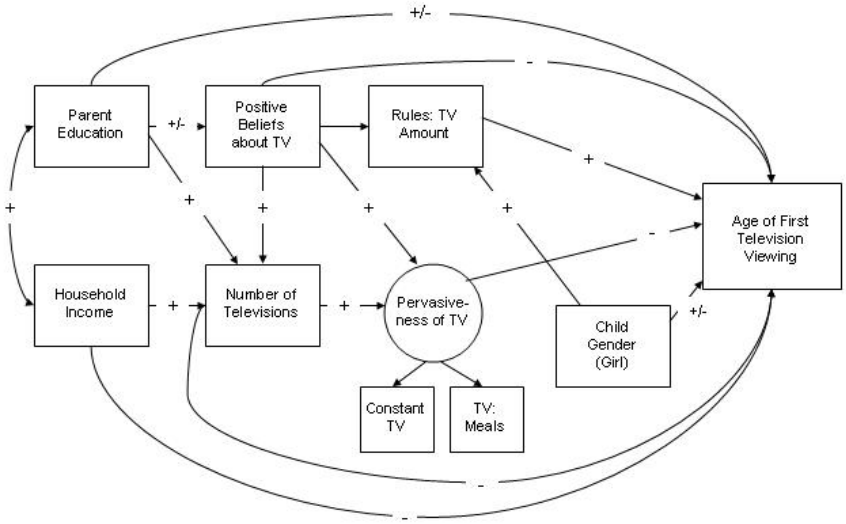
Examining Sociodemographic, Family, and Child Processes Predicting Age of First Use and Amount of Use: Structural Equation Models

Structural equation models (SEMs) were used to test the processes that underlie the interrelations among the constructs outlined in Figure 1. Each medium (television and computer) was analyzed separately for each dependent variable (age of first use and amount of use). Among the three model-testing situations—strictly confirmatory, testing alternative models, and model generating—these analyses fall under the most common scenario: model generation (Jöreskog, 1993). While a body of research has been established that links media use—especially television viewing—with sociodemographic, family, and child characteristics, the manner in which these characteristics might be interrelated has yet to be explored. The proposed analyses involve exploratory model development to investigate these interrelations. The goal in model development is to produce a model that fits the data well statistically and in which every parameter can be interpreted substantively (Jöreskog, 1993). If free parameters that were deleted from the model produced no significant decrement in fit, the model was simplified accordingly (MacCallum, 1995).

Statistical Models

Television. The statistical models showing the operationalization of each construct and their interrelations are presented in Figures 2 and 3. For television, two different models were tested: one used the number of televisions as the measure of availability (Model A, see Fig. 2); the other used the presence of television in the bedroom to indicate availability (Model B, see Fig. 3). Research has indicated that the two measures are differently associated with socioeconomic status: the number of

Statistical Model: Age of First Television Viewing (Model A)



Statistical Model: Time Spent Watching Television (Model A)

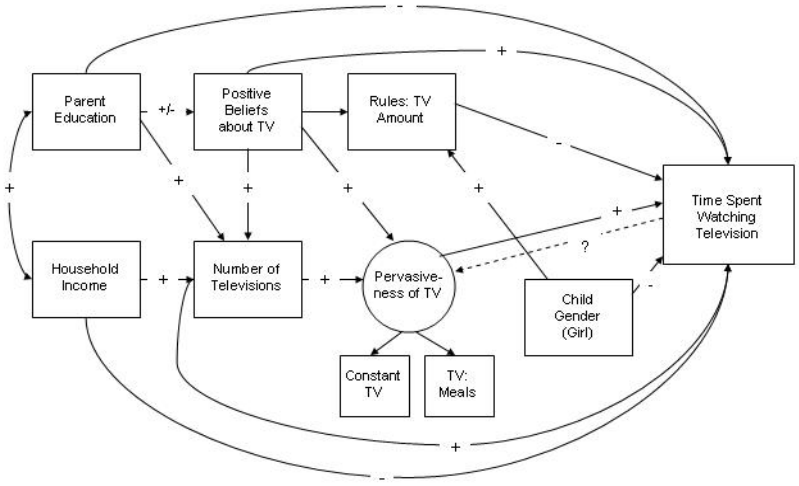
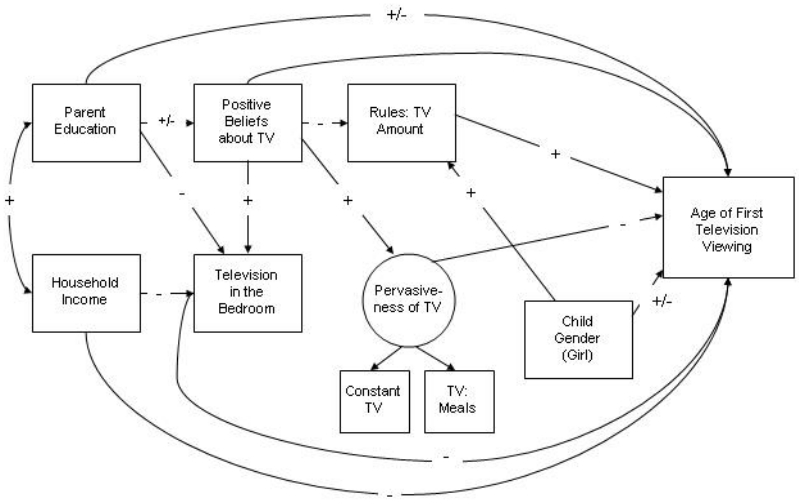


Figure 2. Statistical Model A testing the age of first use (top panel) and time spent watching television (bottom panel) using number of televisions as an indicator of availability. Multigroup models testing age- (0-2, 3-4, and 5-6) and ethnic-group (Black, Hispanic, and White) were run.

Statistical Model: Age of First Television Viewing (Model B)



Statistical Model: Time Spent Watching Television (Model B)

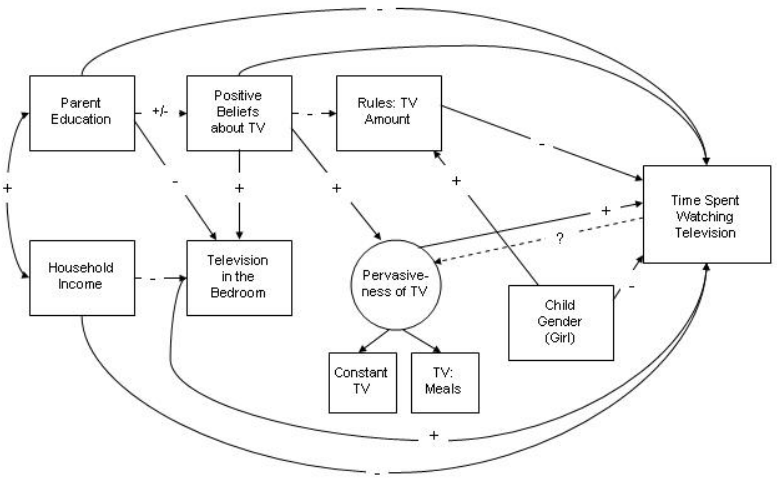


Figure 3. Statistical Model B testing the age of first use (top panel) and time spent watching television (bottom panel) using television in the bedroom as an indicator of availability. Multigroup models testing age- (0-2, 3-4, and 5-6) and ethnic-group (Black, Hispanic, and White) were run.

televisions is positively related to SES, whereas the presence of television in the bedroom is negatively related to SES (Roberts et al., 1999; Woodard & Gridina, 2000). The two variables did not form an appropriate latent measure and were thus analyzed separately. A slight modification was made to Model B: The direct path between television in the bedroom and the pervasiveness of television was omitted because there was little theoretical evidence that the former may cause the latter. The pervasiveness of television in the home was expressed as a latent variable with two indicators: constant television and television during meals.

The models testing time spent with television (bottom of Figs. 2 and 3) included a tentative path from time spent viewing to the pervasiveness of television in the home to test for the possibility that children's television viewing contributed to a pervasive television environment. This path is tentative because adding it to the current proposed model would result in an inadmissible solution; therefore, this path will be tested only if the conditions for identification can be satisfied in the final model.

Computers. The model for computer use appears in Figure 4. Because the data did not contain indicators for the pervasiveness of computer use at home, the construct was excluded. The resulting model was a path model with no latent variables.

Method of Estimation

Structural equation models are typically estimated using maximum likelihood

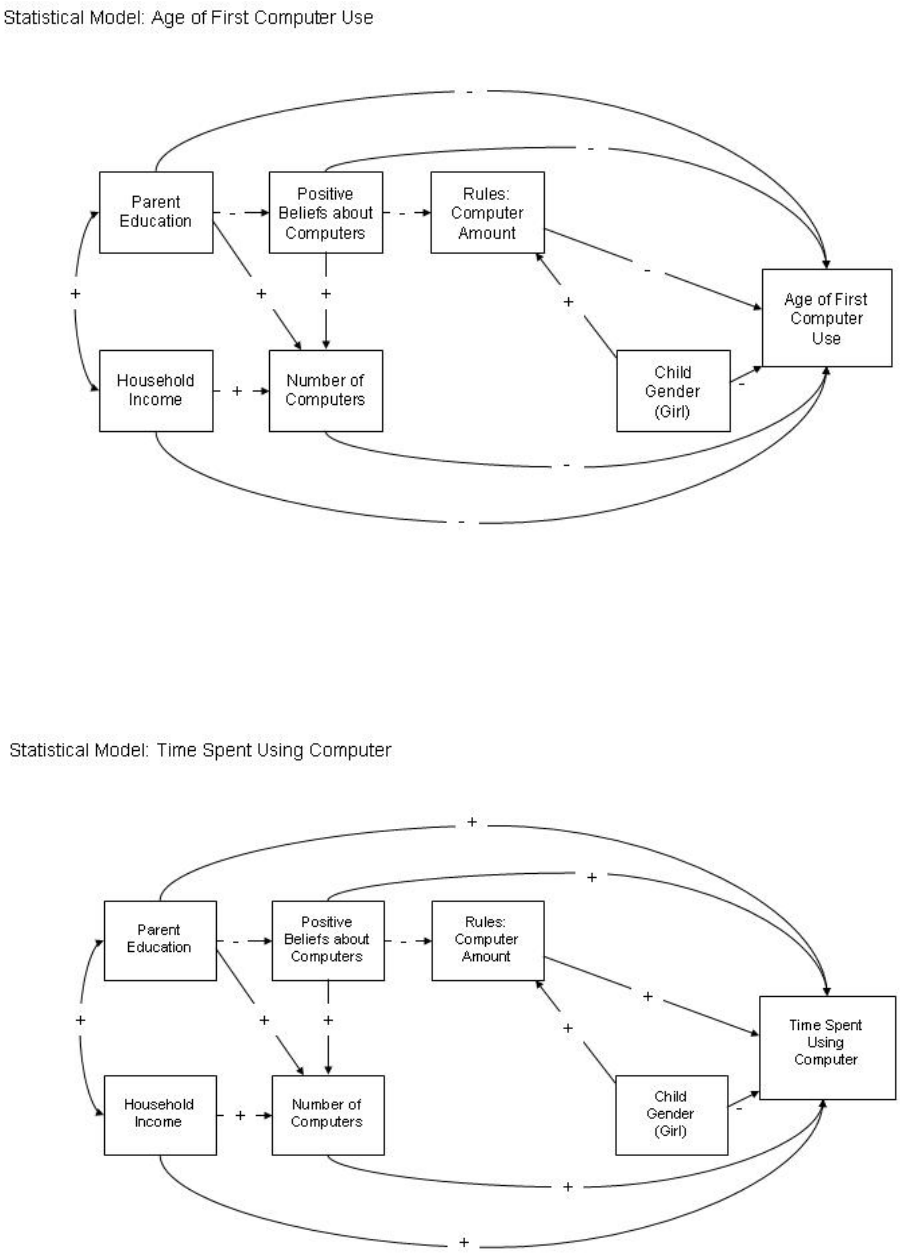


Figure 4. Statistical model testing the age of first use (top panel) and time spent using computers (bottom panel). Multigroup models testing age- (0-2, 3-4, and 5-6) and ethnic-group (Black and Hispanic vs. White) were run.

(ML) or generalized least squares (GLS). Both assume that the data are continuous and multivariate normal. These assumptions could not be fully satisfied in these data because of the presence of censoring and of noncontinuous variables. Using ML or GLS to estimate the model could result in inflated χ^2 values, underestimates of fit, and spuriously low standard errors (West, Finch & Curran, 1995).

Multivariate nonnormal data can be handled using a procedure known as *bootstrapping*. It is a resampling procedure by which many subsamples, called bootstrap samples, are redrawn randomly—with replacement—from the sample under study (Zhu, 1997). Sample statistics, called bootstrap statistics, are computed for each bootstrap sample. Parameter estimates are based on the bootstrap samples, which are free from assumptions about normality (Zhu, 1997). Bootstrap estimates are less biased than ML estimates when the data are nonnormal (Bryne, 2001). Unlike other estimation methods that address nonnormal data (e.g., the asymptotic distribution-free estimator, ADF), bootstrapping can be applied to small sample sizes (Bryne, 2001). For the proposed analyses, structural equation models were analyzed using both normal-theory ML and bootstrap ML (drawn from 1,000 samples from the data) in AMOS 5. Estimates from both methods were compared to ascertain the extent of bias resulting from nonnormality. If the parameter estimates did not differ, normal-theory ML was used to estimate the models because it accounts for sampling weights whereas bootstrap ML does not.

Model Testing and Modification

The specified model was evaluated for goodness-of-fit by examining the χ^2, root mean square error of approximation (RMESA), the comparative fit index (CFI), and the incremental fit index (IFI). A good fit is denoted by a nonsignificant chi-square, a CFI and an IFI close to 1 (which indicates perfect fit), and an RMSEA of .05 or less. The p-value associated with the RMSEA tests the null hypothesis that the model closely fit the data.

Using the strategy outlined by MacCallum (1995), the hypothesized models were first tested using the full sample. Proposed paths were retained if they were significant. Lagrange multiplier indices (or modification indices) were examined to identify additional, theoretically relevant paths that, if added, would enhance model fit. This last step in the model generation process is important, particularly in testing unproven models, because significant bias could result from model specification errors in SEM (MacCallum, 1995).

Multigroup Analyses

Each model was tested for equality across age and ethnic groups. Multiple-group analyses were performed by imposing cross-group equality constraints on model parameters in an increasingly restrictive fashion. For analyses of television viewing, equality constraints were imposed in the following order: (a) measurement weights, (b) structural weights, (c) structural covariances, and (d) structural residuals. Analyses of computer use proceeded in the same order except they did not involve the

testing of measurement weights because no latent variable was represented in the models. The χ^2 from the constrained models were compared successively with that from the preceding model. A significant difference in χ^2 indicates that the equality constraints imposed do not hold, and that one or more parameters tested differ across groups (Byrne, 2001). A nonsignificant change in χ^2 denotes equality across groups in the parameters of interest. If the groups were not substantively different from each other, it was concluded that the same model operated across groups. If any group was different from another, separate models were presented for each group.

For *television use*, multigroup analyses were conducted for three age groups (0-2, 3-4, and 5-6) and for three ethnicities (Black, Hispanic, and White) to test whether relations represented in the model were moderated by group membership. Compared with the older age groups, the 0 to 2 age group encompasses a wider range of cognitive, physical, and social capabilities, but it could not be further differentiated because the resulting sample sizes would be inadequate for analyses. If the tests revealed differences among the three age- or ethnic-groups, further analyses were run to compare each pair of groups.

Analyses of *computer use* were also conducted on three age groups; because of small sample sizes for Black and Hispanic children, they were combined and compared with White children.

Analysis Samples

Analyses were conducted on children who had complete data on all variables.

By definition, this included all children who had watched television or used a computer (i.e., were not censored). Event history analysis allows for censored data to be incorporated, whereas there is no satisfactory way to include right-censored cases in structural equation modeling. For instance, imputing data for censored cases creates artificial values for the age of first use when it is known that the child did not use the medium. Furthermore, different units of analyses (person-year vs. person) and dependent variables are used (hazard vs. age of first use) in event history analyses and SEMs, and the two types of analyses necessitate different samples.

The samples contained children who had complete data on all variables of interest. The *television sample* comprised 750 children (ages 0-2, $n = 254$; ages 3-4, $n = 263$; and ages 5-6, $n = 233$; Black, $n = 86$; Hispanic, $n = 115$, and White, $n = 549$). Six observations with large Mahalanobis distances were deleted from the *computer sample*, resulting in a final sample of 411 children (ages 0-2, $n = 52$; ages 3-4, $n = 171$; and ages 5-6, $n = 188$; Black and Hispanic, $n = 78$; White, $n = 333$). Tables 1 and 2 show the means and standard deviations for all measures for the television and computer samples, respectively.

Bias analyses. Children included in the *television* sample were older, $t(1060) = 6.10$, $p < .01$; had parents who were more highly educated, $t(532) = 2.65$, $p < .01$; had more television sets at home, $t(1063) = 3.27$, $p < .01$; were more exposed to a constant television environment, $t(532) = 2.68$, $p < .01$, watched more television, $t(476) = 6.77$, $p < .01$; were more likely to be Black, $\chi^2(1) = 5.51$, $p < .05$; were less likely to be Hispanic, ,

Table 1

Means and Standard Deviations for All Measures for the Television Sample

	M	*SD*
Child age	3.38	1.75
Child gender (Girl)	.51	.50
Parent education[a]	4.37	1.58
Household income[a]	4.10	1.73
Ethnicity: Black	.15	.36
Ethnicity: Hispanic	.16	.37
Beliefs about television[b]	2.23	.84
Number of televisions	2.73	1.18
Television in the bedroom	.39	.49
Constant television[c]	4.02	1.33
Television during meals[c]	3.41	1.87
Rules about TV time	.69	.46
Age first watched TV (months)	14.49	10.20
Time spent watching TV (minutes)	71.52	71.29

Note. Measures are for the sample used in SEMs and Tobit regressions ($N = 750$).

[a] Range = 1 – 7; [b] Range = 1 – 3; [c] Range = 1 – 6

Table 2

Means and Standard Deviations for All Measures for the Computer Sample

	M	*SD*
Child age	4.19	1.38
Child gender (Girl)	.51	.50
Parent education[a]	4.78	1.47
Household income[a]	4.55	1.58
Ethnicity: Black	.13	.33
Ethnicity: Hispanic	.10	.30
Beliefs about computers[b]	2.86	.42
Number of computers	1.56	1.03
Rules about computer time	.66	.47
Age first used computer (months)	33.26	14.61
Time spent using computer (minutes)	19.11	37.96

Note. Measures are for the sample used in SEMs and Tobit regressions ($N = 414$).

[a] Range = 1 – 7; [b] Range = 1 – 3

$\chi^2(1) = 11.00$, $p < .01$; were more likely to have a television in the bedroom, $\chi^2(1) = 6.36$, $p < .05$; and were less likely to have parents with negative beliefs about television, $\chi^2(2) = 13.12$, $p < .01$; than those who were not in the sample. The two groups did not differ on gender, being an only child, household income, television during meals, and having rules about television.

Bias analyses of the *computer* sample revealed that children in the sample were older, $t(971) = 16.66$, $p < .01$; had parents with more education, $t(903) = 7.95$, $p < .01$, and income, $t(885) = 7.35$, $p < .01$; had more computers at home, $t(739) = 11.34$, $p < .01$; spent more time using a computer, $t(503) = 11.05$, $p < .01$; were more likely to have rules about computer use, $\chi^2(1) = 8.88$, $p < .01$, were more likely to be Black or Hispanic, $\chi^2(1) = 32.01$, $p < .01$; and were more likely to have parents with positive beliefs about computer, $\chi^2(1) = 28.61$, $p < .01$ than those excluded. The two groups did not differ from children excluded from the sample on gender and the likelihood of being an only child.

Examining the Relation between Age of First Use and Amount of Use: Tobit Regressions

Censored variables manifest themselves in another way in these data: Many children have a value of zero for time spent watching television and in particular, using computers, in part because the child may not have used television or computers on the specific day sampled. Transforming such time use variables does not solve the problem of censoring because observations with a value of zero do not respond to transformations. Alternatives such as including the censored observations as zeros in

OLS regressions or truncating the sample to exclude those observations will result in inconsistent estimates (Long, 1997). By contrast, Tobit regression accounts for all the information, including censoring, and provides consistent parameter estimates (Long, 1997).

The dependent variable in Tobit analyses is interpreted as an underlying latent variable (Breen, 1996). The latent variable is realized (or observable) above the censoring point (i.e., zero in these time-use data). The observations are separated into uncensored and censored observations. The uncensored observations are treated in the same way as they are in linear regression models; for the censored observations, the specific value of the dependent variable is unknown but can be estimated by computing the probability of being censored given the independent variables (Breen, 1996; Long, 1997). Tobit models employ maximum likelihood (ML) estimation to estimate the association between the independent and dependent variables. The resulting coefficients are hybrids of unstandardized coefficients produced by OLS regression and odds ratios produced by logistic regression. The more censored the dependent variable is, the more the estimates resemble odds ratios; the less censored the dependent variable is, the more the estimates resemble unstandardized regression coefficients.

For the proposed analyses, Tobit regressions were used to examine the relation between the age of first use and time spent using television and computers, after accounting for the sociodemographic, family, and child predictors in the model.

Quadratic relations between age of first use and amount of use were also tested to examine possible nonlinear associations. To assess possible moderating effects, interactions between the age of first use and sociodemographic predictors (parent education, income, and ethnicity) were included as a second block in the regression models. The analysis samples were the same as those used for SEMs. Regressions were performed using the "intreg" command in Intercooled Stata 8.

Limitations and Concerns

Some limitations regarding these data must be noted. The data were collected entirely through global assessments from the same respondent for each household. Global assessments are prone to bias for several reasons. They tend to yield higher estimates of time use compared with other methods of measurement (i.e., time diary or experiential sampling). In other cases, such as the estimation of nonsalient activities, global assessments produce underestimates of time use, particularly when they are compounded by lengthy recall periods (Juster, Ono, & Stafford, 2003). Studies that specifically examined the measurement of media use have suggested that with the exception of book reading, adult respondents consistently underreported media use (e.g., television viewing and computer use) in global assessments compared with the diary method or observer records (Papper, Holmes, & Popovich, 2004).

Global assessments also fail to capture the multitasking of media accurately. Observations of toddlers' media use indicated that they often did other things while "watching" television: Less than half their time (40.6%) was spent actually looking at

the television; they were engaged in social interactions 39.2% of the time and played 32.1% of the time (Schmitt, 2001). Others have similarly found secondary activities to be prevalent—particularly among young children—during viewing (Wright et al., 2001). How parents account for their children's viewing in the presence of these concurrent activities is unclear. Given that adults are often unaware of their own use of media (Papper et al., 2004), the reliability of parents' reports of their young children's use is uncertain.

In fact, how parents conceptualize young children's television and computer use is itself ambiguous. "Use" connotes purposeful, self-directed media consumption; infants and toddlers do not really use media in such a way. Young children's attention is sporadic at best (Jordan & Woodard, 2001): Attention to television becomes increasingly sustained among toddlers, but among infants younger than 12 months, "viewing" only entailed brief glances at the television (Schmitt, 2001). The notion of exposure may be more appropriate for describing media consumption among very young children, but because parents were asked about children's media use (rather than exposure) in this survey, the term "use" was retained in order to be consistent with the language of the survey.

Respondents also often over-report activities deemed socially desirable and underreport activities that are undesirable (Juster et al., 2003); in the case of media use, for instance, parents may exaggerate reports of conscientious behavior— such as regulation— to appear as "good" parents (Desmond et al., 1985). Global assessment

data may be less vulnerable to bias when the activity measured occurs regularly and is structured externally (Juster et al., 2003), but it is unclear the extent to which television and computer use is structured in the households sampled.

Another concern pertains specifically to the retrospective nature of the data, especially those regarding the age of first use. Errors that could arise from retrospective data include memory failures, particularly if a long period of time has elapsed since the event; telescoping (i.e., events remembered as having occurred more recently than they actually did), and rounding (i.e., respondents report even numbers or numbers ending in 0 or 5 and dropping fractions; Singer & Willet, 1991).

A final note is that the correlational nature of these data precludes the ability to make causal inferences. Although the structural equation models represent hypotheses about causal relations among variables, failure to reject the model does not prove that it is correct (Kline, 1998). In this study, inferences about causation were made based on knowledge of the existing research. Longitudinal designs would allow one to better specify and evaluate causal effects.

RESULTS

The results section is organized according to the major research questions posed in this study. Those regarding how early children watch television and use computers are addressed first; results from event history analysis and structural equation models predicting the age of first use are shown. The next section centers on SEMs predicting the amount of time children spent with television and computers, and lastly, Tobit regressions testing the relation between the age of first use and amount of use are presented.

Age of First Use

Recall that event history analysis was used to investigate the onset of television and computer use among all children, and SEMs were used to examine the sociodemographic, family, and child processes that predict the age of first use among children who had already used those media.

Which Children Have Ever Watched Television or Used a Computer?

Predictors of which children had ever used each medium appear in Tables 3 and 4. Of the samples, 59 children (7.3%) of children had not watched television and 412 (49.4%) had not used a computer. Logistic regressions revealed that age was strongly related to whether children had used a television or computer. Older children, having lived longer, have had more opportunity to use each medium. These analyses suggest that positive parental beliefs about television and being in a constant-television household increased the likelihood of watching television (see Table 3).

Table 3

Results from Logistic Regression Predicting Which Children Had Ever Watched Television

Predictors	Odds ratio	*SE*
Child age	2.64***	.37
Parent education	1.21	.17
Household income	.82	.10
Ethnicity: Black	2.58	2.57
Ethnicity: Hispanic	.60	.23
Only child	.96	.30
Child gender	1.19	.39
Beliefs about television	2.08***	.38
Number of televisions	1.01	.16
Television in the bedroom	1.41	.60
Constant television	1.52**	.21
Television during meals	.90	.09

***$p < .001$, **$p < .01$

Parent education, parental beliefs about computers, and the number of computers in the home were positively associated with whether children had ever used a computer (see Table 4).

When Children First Watched Television or Used Computer

Cohort differences in the percentage of children who have watched television and used a computer are shown in Tables 5 and 6 respectively. The differences were especially marked in the number of children who had watched television prior to age 1 (see Table 5): A substantially larger portion of children in the 0-to-2 cohort had watched television before they were a year old compared to those in the 3-to-4 and 5-to-6 cohorts. Cohort differences were also apparent for computer use (see Table 6), such that use was more likely to start prior to age 2 in the youngest cohort compared to other cohorts, and a greater percentage of children in the 3-to-4 cohort first used a computer at age 2 compared to those in other cohorts.

Recall that *hazard functions* are the most appropriate tool for describing patterns of event occurrence; they show the unique probability of use associated with each time period. An examination of the variation in the magnitude of the hazard function reveals when events are particularly likely or unlikely to occur (Singer & Willet, 2003). Hazard can also be conceptualized as *incidence*: the number of new events occurring during a time period. The *survivor function* cumulates the period-by-period probability of event occurrence to evaluate the likelihood that a randomly

Table 4

Results from Logistic Regression Predicting Which Children Had Ever Used a Computer

Predictors	Odds ratio	*SE*
Child age	2.16***	.13
Parent education	1.22**	.09
Household income	.97	.07
Ethnicity: Black	.79	.27
Ethnicity: Hispanic	.67	.20
Only child	1.31	.25
Child gender	.84	.15
Beliefs about computers	1.87**	.36
Number of computers	2.14***	.30

***$p < .001$, **$p < .01$

Table 5

Cohort Differences in Age of First Television Use

	Cohort (Age in 2003)					
	0-2 (*n* = 308)		3-4 (*n* = 271)		5-6 (*n* = 237)	
Age of first use	*n*	*%*	*n*	*%*	*n*	*%*
Less than 1	151	49.02	81	29.89	52	21.94
1	91	29.55	87	32.10	77	32.49
2	15	4.87	78	28.78	56	23.63
3	--	--	21	7.75	36	15.19
4	--	--	--	--	9	3.80
5	--	--	--	--	3	1.27
6	--	--	--	--	--	--

Table 6

Cohort Differences in Age of First Computer Use

	Cohort (Age in 2003)					
	0-2 (*n* = 313)		3-4 (*n* = 276)		5-6 (*n* = 245)	
Age of first use	*n*	*%*	*n*	*%*	*n*	*%*
Less than 1	11	3.51	1	.36	5	2.04
1	26	8.31	17	6.16	7	2.86
2	21	6.71	77	27.90	28	11.43
3	--	--	64	23.19	56	22.86
4	--	--	13	4.71	62	25.30
5	--	--	--	--	30	12.24
6	--	--	--	--	4	1.63

selected individual will not experience the event (i.e., "survive"). Survival is equivalent to *prevalence*, wherein a higher survival function denotes lower prevalence.

To facilitate comparison of the differences in the onset of television viewing and computer use, the hazard (top panel) and survival (bottom panel) functions of both media are shown jointly in Figure 5. Compared with television viewing, the hazard function for computer use is lower in every year, indicating that the probability of use in every year was lower. The survival functions (see bottom of Fig. 5) indicate that television viewing was more prevalent at all ages than was computer use. The *median lifetime*—the period during which an estimated half of the sample has experienced the event and half has not—was much earlier for television viewing (between 1 and 2 years old) than it was for computer use (between 4 and 5 years old; see bottom of Fig. 5).

Television

As shown in the top panel of Figure 5, more than 17% of children watched television in their first year of life. Among those who had not watched television in the first year, an estimated 30% watched during the next year. Among those who had not yet watched in either of these periods, an estimated 45% started between ages 2 and 3; another 57% of those who had not watched before turning 3 started between ages 3 and 4. The probability of viewing then declined to 39% between ages 4 and 5, and to 43% between ages 5 and 6.

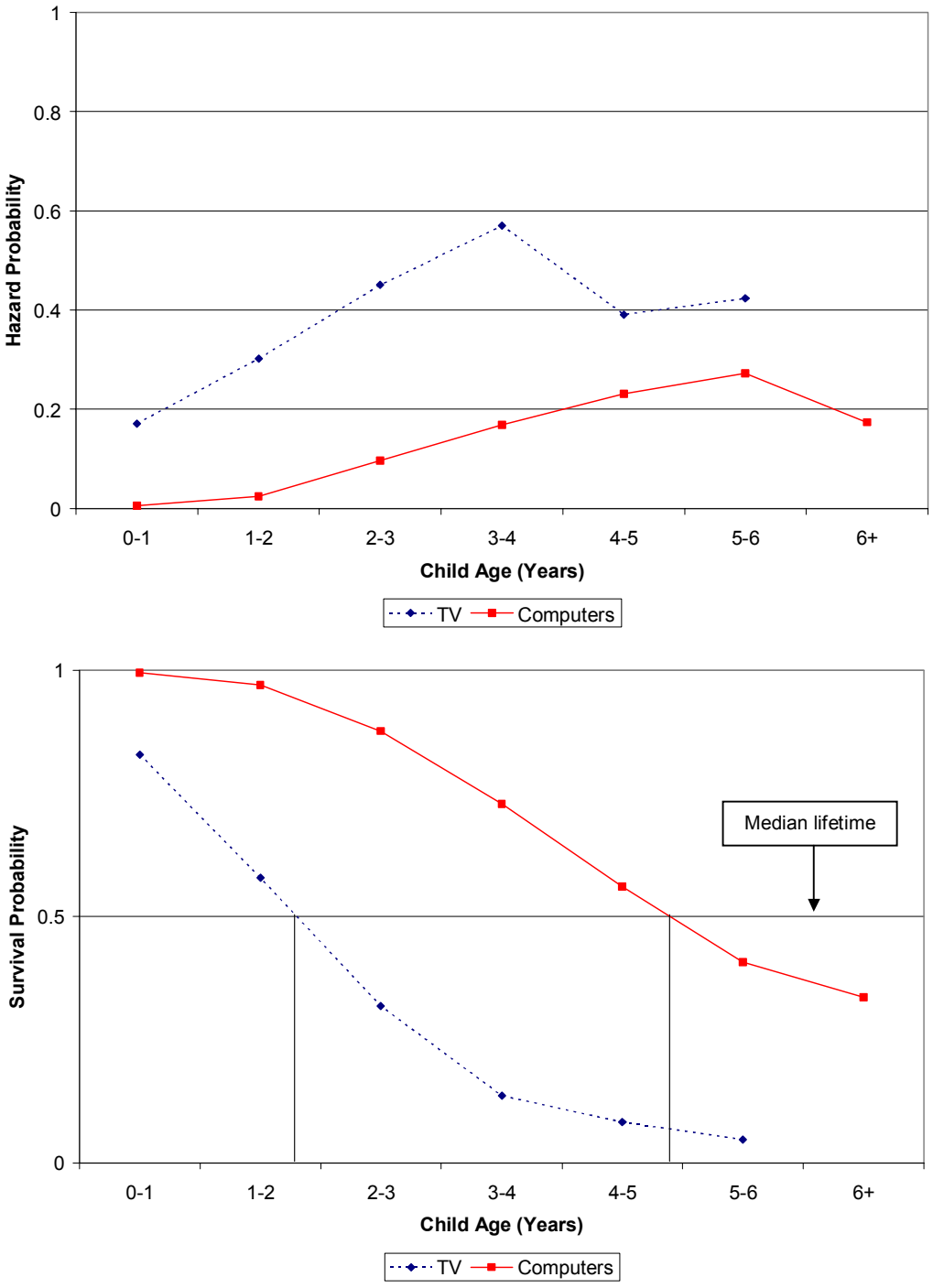


Figure 5. Hazard and survivor functions comparing the onset of television and computer use. Last observed age of exit for television use was 5 to 6; last observed exit for computer use was before age 7.

Computers

Less than 1% of children had used a computer in their first year of life (see Fig. 5, bottom panel). Between ages 1 and 2, 2.4% of nonusers had used a computer; thereafter, a further 9.6% of nonusers used a computer between the ages of 2 and 3. Among those who had not used a computer by age 3, 16.9% started between the ages of 3 and 4. An additional 23% started between ages 4 and 5. The probability of first use rose to 27% when the children were between 5 and 6 years old. Thereafter, the probability dropped to 17% among those who had not yet used a computer.

Differences in Timing of First Use by Sociodemographic, Family, and Child Characteristics

Event-history models do not focus on the age of first use directly but rather on the hazard rate—a transformation of age that remains meaningful with the presence of censoring. The results from discrete-time hazard models for television are shown in Table 7. The first set of terms shown in the models are time indicators that act as multiple intercepts, one for each time period. Taken together, these estimates represent the baseline logit hazard function: the value of the logit transformation of hazard when all other substantive predictors are 0 (Singer & Willet, 2003). In these analyses, no constraints were placed on the shape of this function. Model 1 shows the relation between hazard and sociodemographic predictors; Model 2 shows the added association with family media ecology; and Model 3 shows the added predictive power of child characteristics. These nested models can be compared by calculating a deviance statistic:

Table 7

Results of Fitting a Series of Discrete-Time Hazard Models Predicting First Use of Television

	Model 1			Model 2			Model 3		
Predictor	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio
Time (in years)									
0-1	-.732	.208	--	-1.866	.315	--	-1.959	.321	--
1-2	-.123	.212	--	-1.211	.310	--	-1.296	.316	--
2-3	.490	.235	--	-.534	.321	--	-6.18	.325	--
3-4	1.106	.325	--	.082	.391	--	-.002	.395	--
4-5	.377	.549	--	-.642	.567	--	-.725	.571	--
5-6	-.143	.843	--	-1.005	.829	--	-1.085	.826	--
Sociodemographic factors									
Parent education	.064	.039	1.066	.083*	.040	1.087	.079*	.040	1.082
Household income	-.046	.037	.955	-.032	.039	.969	-.028	.039	.972

Table continues

	Model 1			Model 2			Model 3		
	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio
Black	.387*	.176	1.472	.429*	.184	1.537	.443*	.184	1.560
Hispanic	-.124	.156	.883	-.062	.158	.940	-.057	.159	.945
Family TV ecology									
Beliefs about TV	--	--	--	.188**	.065	1.207	.185**	.065	1.200
Number of TVs	--	--	--	-.048	.055	.953	-.040	.055	.961
TV in the bedroom	--	--	--	-.292*	.133	.747	-.304*	.133	.738
Constant TV	--	--	--	.195***	.051	1.215	.202***	.051	1.220
TV during meals	--	--	--	.001	.035	1.001	-.004	.035	.996
Child characteristics									
Only child	--	--	--	--	--	--	.176	.119	1.190
Child gender	--	--	--	--	--	--	.039	.108	1.040
(df) Deviance	(10) 2176.11***			(15) 2138.47***			(17) 2136.07***		

Table continues

	Model 1	Model 2	Model 3
Δ(df) Deviance	--	Δ(5) 37.37***	Δ(2) 2.40

Note. Analyses were based on 1,661 observations (i.e., person-years) representing 816 children.

*** $p < .001$, ** $p < .01$, * $p < .05$.

$$\text{Deviance} = -2\ (\log \text{likelihood})_{\text{model}}$$

between a reduced model and the current model. The difference in deviance is evaluated with a χ^2 statistic with the degrees of freedom equal to the number of predictors (Singer & Willet, 2003). If the difference is significant, we can conclude that the current model being evaluated is preferable to the reduced model.

Television

A comparison of the deviance statistic between Models 1 and 2 showed that Model 2 added significant explanatory power to Model 1 but Model 3 did not further inform the relation between hazard and predictors. Therefore, Model 2 was considered the appropriate model for predicting the onset of television viewing.

Among the sociodemographic predictors in Model 2 (see Table 7), parent education and ethnicity were related to whether and when children watched television. During every year represented, the likelihood of first viewing was higher for children whose parents were more highly educated than for those with less well-educated parents. The differences in hazard and survival probabilities by parent education appear in the left panels of Figure 6. For purposes of illustration, levels of parent education were classified as "no college degree" and "college degree or post-graduate education." The hazard for children in the two groups were similar until ages 3 to 4, after which the probability of the onset of viewing continued to rise among those whose parents were less educated, whereas it dropped sharply among children with better-educated parents. All children whose parents did not have a college

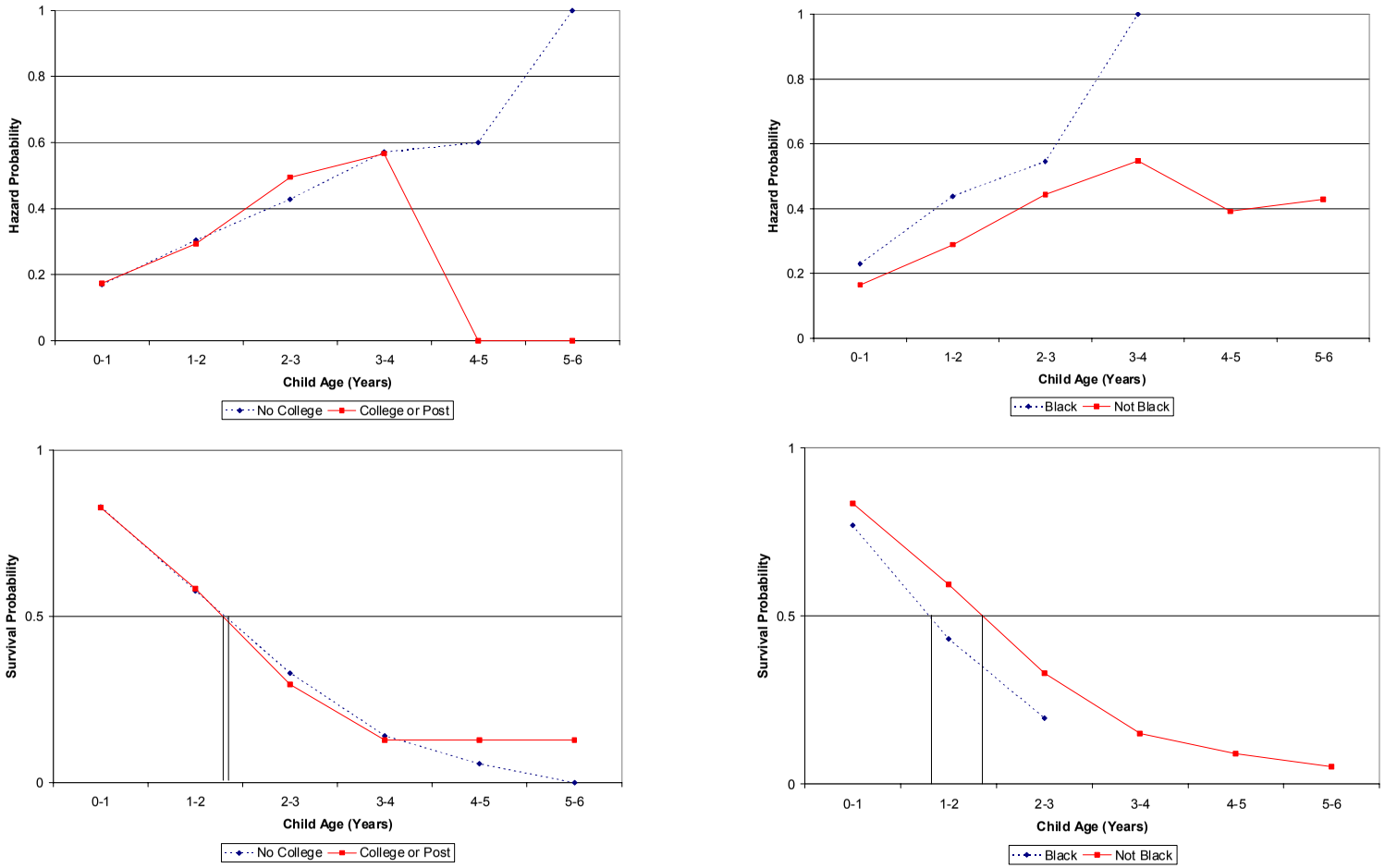


Figure 6. Hazard (top panels) and survival (bottom panels) functions depicting the probability of the onset of television viewing by parent education (left panels) and ethnicity (right panels). Hazard and survival functions shown have not been adjusted for effects of other variables in the model.

degree had watched television prior to age 7, whereas almost 13% of children (4 children) with college-educated parents did not watch television before age 7. These descriptives seem to suggest that children with less well-educated parents watched television earlier, which contradicts the results from the discrete-hazard model. The apparent differences may be due to the fact that the hazard and survival functions were plotted without controlling for effects of other variables, whereas the hazard models account for covariates; categorizing parent education into two groups also attenuates variance, and the most pronounced differences may not lie between those with and without a college degree.

Black children were more likely to watch television than were non-Black children (see Model 2, Table 7). The ethnic-group differences in hazard and survival probability can be found in the right panels of Figure 6. Both the incidence (hazard) and prevalence (survival) of viewing was consistently higher among Black children than among non-Black children. Among Black children, the probability of viewing rose dramatically between the ages of 3 and 4 (no information was available thereafter because the last observed period among these children was in years 3 to 4). Non-Black children were also most likely to start watching television between 3 and 4 years old, but the incidence of first viewing was much lower compared with Black children.

Children whose parents had more positive beliefs about television were more likely to start watching it than were those whose parents had less positive beliefs (see Model 2, Table 7). An examination of the hazard and survival functions (left panels of

Fig. 7) showed that children whose parents had negative beliefs about television had the lowest probability of viewing at every age with the exception of years 2 to 3. The relation between beliefs and likelihood of viewing differed depending on the child's age. Prior to age 2, children whose parents had favorable attitudes towards television were most likely to view it, followed by those whose parents had neutral attitudes, then negative attitudes. Beyond age 3, the hazard functions diverged such that children of parents with neutral attitudes toward television displayed the greatest probability of viewing at every age, followed by those with positive, then negative attitudes. The survival functions show the overall prevalence of viewing to be consistently lowest among those with negative beliefs. Before age 2, viewing was less prevalent among those with neutral beliefs than those with positive beliefs; beyond age 3, the relative prevalence for these two groups switched.

The finding that children whose parents had neutral beliefs were more likely to watch television than were those whose parents had positive beliefs ran counter to expectations. Because the hazard and survivor functions displayed did not control for effects of other variables, group differences in hazard and survival may be confounded with other factors such as parent education or income. Follow-up analyses revealed that parents with neutral beliefs were less likely to have graduated from college, $\chi^2(2) = 9.92$, $p < .01$, and more likely to have lower income, $\chi^2(2) = 9.68$, $p < .01$, than were parents of the other two groups, suggesting that such confounding factors might be driving these results.

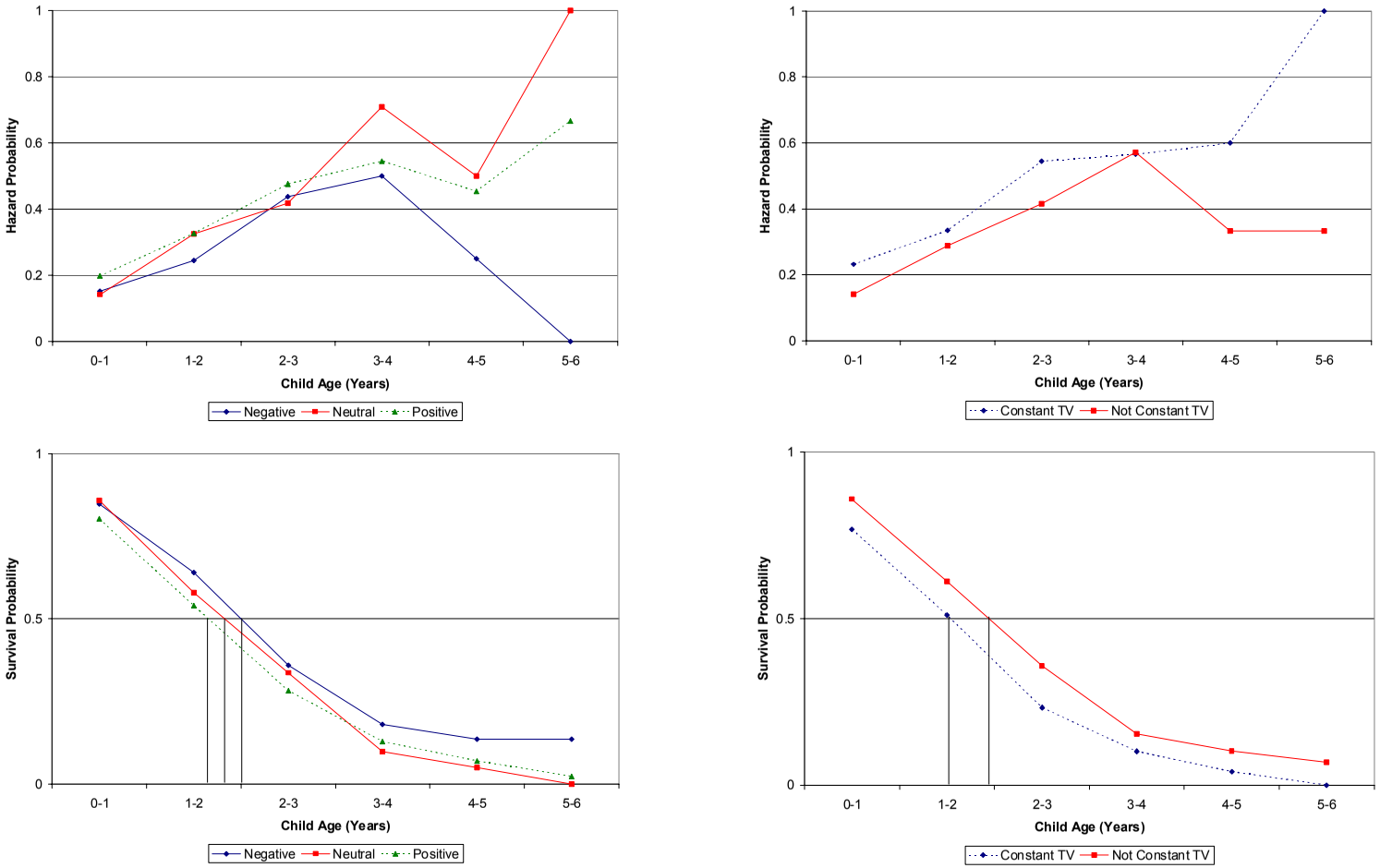


Figure 7. Hazard (top panels) and survivor (bottom panels) functions depicting the probability of the onset of television viewing by parental beliefs (left panels) and constant television (right panels). Hazard and survival functions shown have not been adjusted for effects of other variables in the model.

Children who lived in homes where the television was turned on constantly were more likely to watch it at a younger age compared to those who lived in homes where television was less pervasive (see Table 7). The hazard and survivor functions are shown in the right panels of Figure 7. For descriptive purposes, a "constant television" household was defined as one in which the television was on most or all of the time. The figures indicate that children who lived in constant-television homes were more likely to initiate viewing during every year (except years 3-4, when the likelihood was similar for children in both groups) than were those not in constant-television homes. By the end of age 6, all children living in constant-television homes had watched television, whereas almost 7% of those in non-constant-television homes had yet to watch television. The overall prevalence of viewing was consistently higher for those in constant-television homes than those who were not.

As shown in Table 7, children who had a television in the bedroom were *less* likely to watch it compared to those without a television in the bedroom. An examination of the hazard function (top of Fig. 8) reveals that children without a television in the bedroom were more likely to initiate viewing during every year between ages 0 to 3 than were those with a bedroom set. At older ages—in particular, between 3 to 4 and 5 to 6— children with a bedroom television were more likely to start watching than were those without one. The survival function (Fig. 8, bottom panel) shows that viewing was more prevalent among those without a television in their room up till age 5, after which viewing was more prevalent among those with a

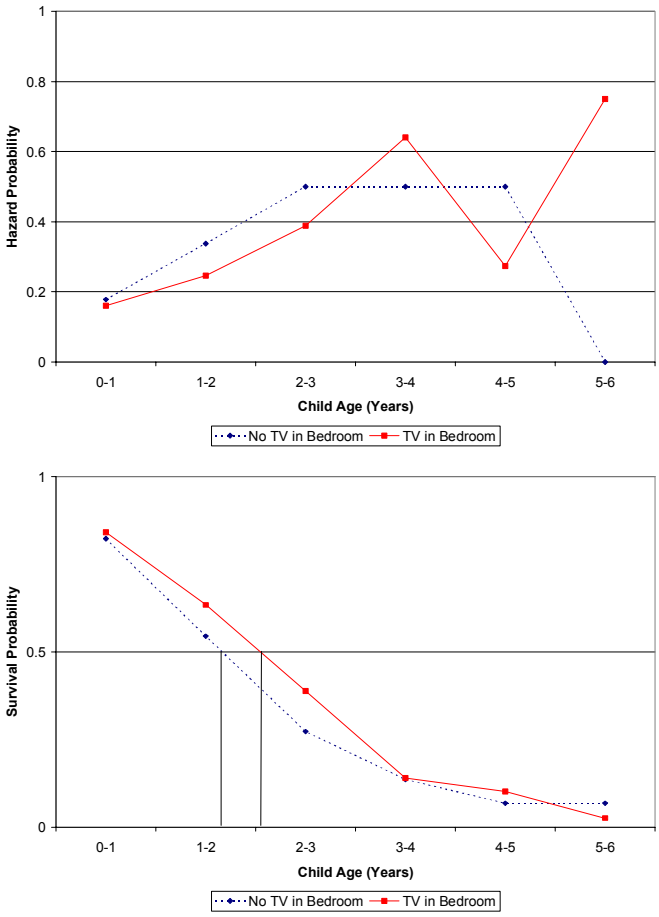


Figure 8. Hazard (top panel) and survivor (bottom panel) functions depicting the probability of the onset of television viewing by having a television in the bedroom. Hazard and survival functions shown have not been adjusted for effects of other variables in the model.

bedroom set. It is difficult to discern whether having a television in the bedroom is truly associated with how early children watch television because the data did not include whether children had a television in the bedroom during the year they started watching television, only whether they currently had a television in their room. Only 21 children in the sample started watching television during the year they were interviewed (i.e., their current age was the same as their age of first use) and had a television in their rooms. Thus, these findings must be interpreted with caution.

Computers

Table 8 displays the hazard models predicting first use of a computer. Model 2 added predictive power to Model 1, suggesting that both demographic and family characteristics were important in predicting whether and when children used computers. Child characteristics (Model 3) did not contribute further explanatory power, so Model 2 was used to evaluate relations between hazard and its predictors.

Several sociodemographic predictors were associated with the onset of computer use. In each time period under study, children whose parents were more educated were more likely to use a computer than were those whose parents were less educated (see Model 2, Table 8). Hispanic children were less likely to have used a computer than were non-Hispanic children.

The hazard and survivor functions depicting differences in computer use by parent education and ethnicity are shown in Figure 9. The survivor functions indicate that the prevalence of computer use was higher among those whose parents had more

Table 8

Results of Fitting a Series of Discrete-Time Hazard Models Predicting First Use of the Computer

	Model 1			Model 2			Model 3		
Predictor	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio
Time (in years)									
0-1	-5.102	.346	--	-6.834	.565	--	-6.921	.580	--
1-2	-3.868	.273	--	-5.576	.503	--	-5.653	.521	--
2-3	-2.509	.254	--	-4.170	.479	--	-4.229	.495	--
3-4	-1.995	.249	--	-3.604	.472	--	-3.652	.487	--
4-5	-1.721	.265	--	-3.261	.472	--	-3.307	.487	--
5-6	-1.562	.309	--	-2.976	.482	--	-2.993	.498	--
6+	-2.474	.632	--	-3.838	.735	--	-3.832	.736	--
Sociodemographic factors									
Parent education	.197***	.045	1.218	.167***	.048	1.182	.160**	.048	1.173

Table continues

	Model 1			Model 2			Model 3		
	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio	Coeff.	SE	Odds Ratio
Household income	.076	.041	1.079	-.013	.045	.987	-.002	.046	.998
Black	-.166	.201	.847	-.316	.212	.729	-.304	.212	.738
Hispanic	-.560**	.203	.571	-.498*	.202	.608	-.479*	.203	.619
Family TV ecology									
Beliefs about computers	--	--	--	.579***	.139	1.784	.583***	.140	1.792
Number of computers	--	--	--	.412***	.058	1.510	.420***	.058	1.522
Child characteristics									
Only child	--	--	--	--	--	--	.249	.138	1.118
Child gender	--	--	--	--	--	--	-.144	.119	.866
(df) Deviance	(11) 1936.27***			(13) 1863.59***			(15) 1858.36***		
Δ(df) Deviance	--			Δ(2) 72.68***			Δ(2) 5.23		

Note. Analyses were based on 2,903 observations (i.e., person-years) representing 834 children. *** $p < .001$, ** $p < .01$, * $p < .05$.

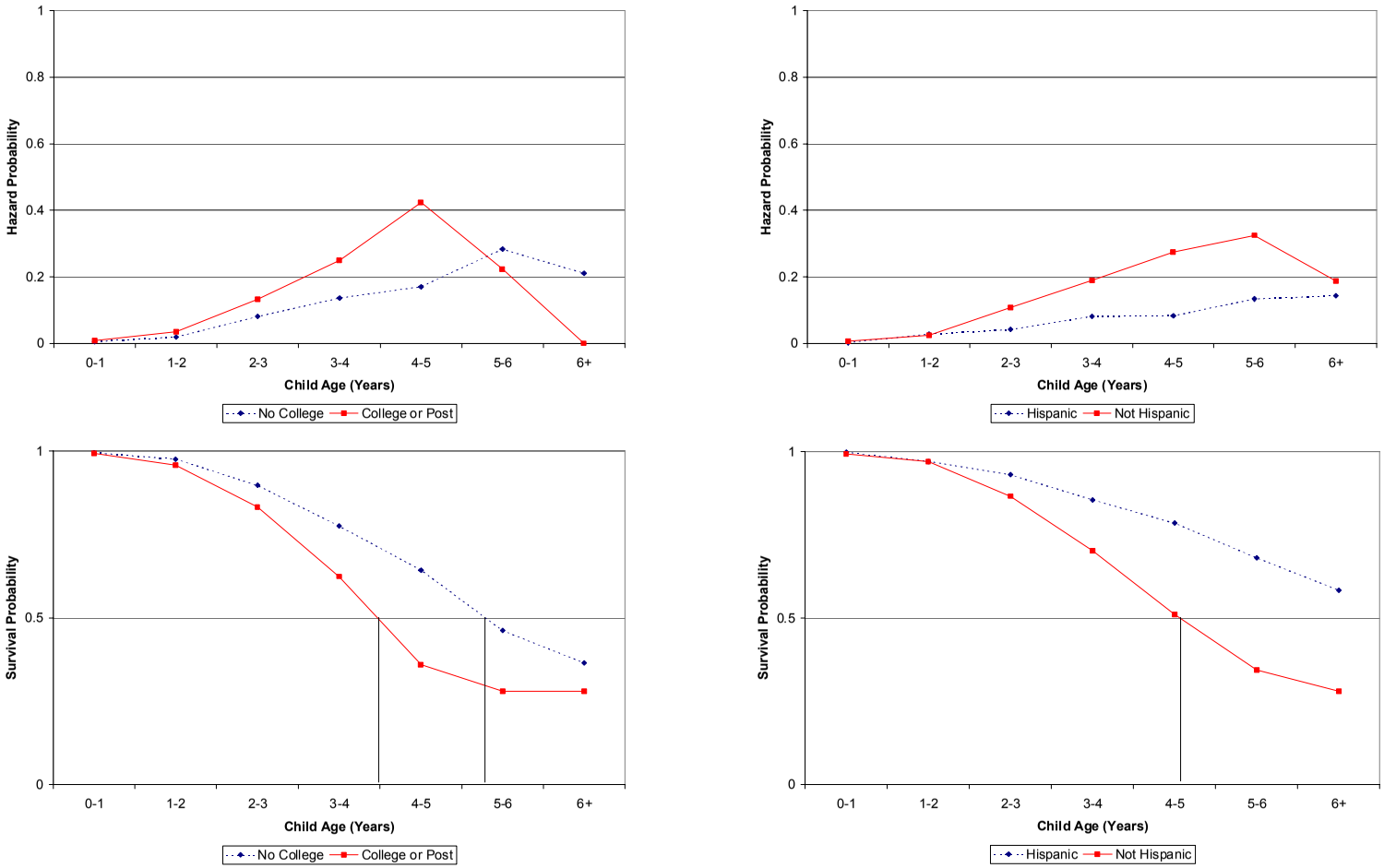


Figure 9. Hazard (top panels) and survivor (bottom panels) functions depicting the probability of the onset of computer use by parent education (left panels) and being Hispanic (right panels). Hazard and survival functions shown have not been adjusted for effects of other variables in the model.

education (see bottom-left panel, Fig. 9). Children whose parents had at least a college degree were most likely to start using a computer between ages 4 and 5, whereas those whose parents were not college educated were most likely to use it a little later—at ages 5 to 6 (see top-left panel, Fig. 9). The probability of use remained low among those whose parents had less education.

Hispanic children had both a lower incidence and prevalence of use compared with non-Hispanic children (see right panels, Fig. 9). The probability of initiating computer use at any year during the first 6 years was less than 15% among Hispanic children, compared with up to 33% for non-Hispanic children (see top-right panel, Fig. 9). Half of non-Hispanic children had used a computer by the age of 5, whereas less than half of Hispanic children had used one by the end of age 6 (see bottom-right panel, Fig. 9).

The family ecology of computer use predicted children's computer use in addition to sociodemographic characteristics (see Model 2, Table 8). During each year represented, children whose parents had positive beliefs about computers were more likely to use a computer than were those whose parents had negative beliefs. Children whose parents had negative beliefs were least likely to start using a computer at every age; those whose parents had positive beliefs were most likely to start using except during the last year (see top-left panel, Fig. 10). Accordingly, the prevalence of use was highest among those with positive beliefs and lowest among those with negative beliefs (see bottom-left panel, Fig. 10).

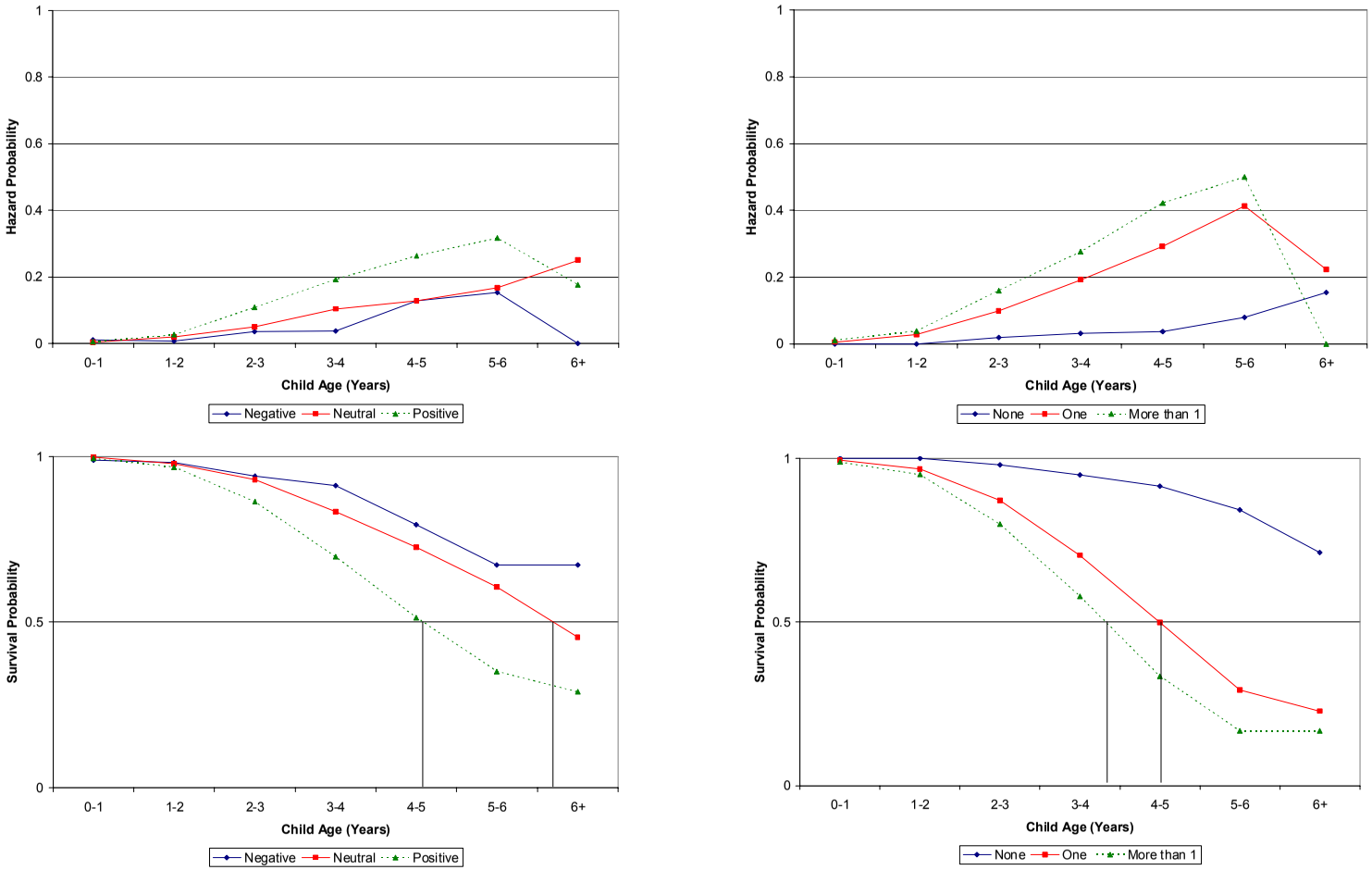


Figure 10. Hazard (top panels) and survivor (bottom panels) functions depicting the probability of the onset of computer use by parental beliefs about television (left panels) and number of computers (right panels). Hazard and survival functions shown have not been adjusted for effects of other variables in the model.

Children who lived in homes with more computers were more likely to use a computer than were those who lived in homes with fewer computers (see Table 8). Those in homes with more than one computer had a high and increasing probability of initiating use throughout the first 6 years; those in homes without a computer had low probabilities of first use at every age (see top-right panel, Fig. 10). By the age of 7, only 17% of children in homes with more than one computer and 23% of children in homes with one computer had not used one, whereas more than 71% of those in homes without a computer had never used one (see bottom-right panel, Fig. 10) .

Sociodemographic, Family, and Child Processes Predicting the Age at Which Children First Watched Television

Event history analysis provided a description of the distribution of time until a child first watched television or used a computer. The next set of analyses presented aims to uncover the ways in which sociodemographic and family characteristics mediate the age at which children first used either medium. Table 9 shows the means and standard deviations for all measures by age group. Correlations among all variables in this sample can be found in Appendix A.

All proposed models—including those how much media children used—were first run with and without bootstrapping. The magnitude of the bias between bootstrap ML estimates and normal-theory ML estimates were compared. The bias in parameters across all models tested was very small (ranging from .000 to .007); examinations of the parameter estimates obtained from the two methods of estimation

Table 9

Means and Standard Deviations for All Measures for the Television Sample by Age Group

	Age groups						
	0-2 (n = 254)		3-4 (n = 263)		5-6 (n = 233)		
Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 747)
Parent education[a]	4.23	1.56	4.50	1.55	4.40	1.60	1.92
Household income[a]	3.68[ab]	1.83	4.33[a]	1.60	4.31[b]	1.67	11.81**
Ethnicity: Black	.17	.38	.15	.36	.14	.34	.59
Ethnicity: Hispanic	.17	.37	.16	.37	.15	.36	.06
Child gender (girl)	.52	.50	.51	.50	.50	.50	.08
Only child	.37[a]	.48	.29	.45	.26[a]	.44	4.06*
Beliefs about TV[b]	2.19	.83	2.28	.83	2.20	.87	.85
Number of TVs[c]	2.55[a]	1.11	2.78	1.21	2.87[a]	1.20	4.88**
TV in the bedroom	.29[a]	.46	.39	.49	.48[a]	.50	9.49***

Table continues

	0-2		3-4		5-6		
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 747)
Constant TV[d]	4.14[a]	1.33	4.11	1.27	3.79[a]	1.36	5.16**
TV during meals[d]	3.51	1.86	3.47	1.87	3.22	1.88	1.71
Rules: time with TV	.62[ab]	.49	.72[a]	.45	.75[b]	.44	5.60**
Age of first use (months)	9.22[ab]	4.76	15.50[ac]	9.27	19.22[bc]	12.70	67.99***
Time watching TV (minutes)	70.44	76.80	75.96	71.55	67.76	64.35	.87

Note. Age groups that share the same superscript across rows are significantly different from each other at $p < .05$ according to Tukey's *HSD*.

[a] Range = 1-7; [b] Range = 1-3; [c] Range = 1-6; [d] Range = 1-5

*** $p < .001$, ** $p < .01$, * $p < .05$.

did not reveal substantive differences, suggesting that the steps taken to address multivariate nonnormality—deleting outliers and transforming variables— may have eliminated the need for bootstrapping. Thus, all structural equation models were estimated without bootstrapping in order to account for sampling weights. All models were also tested with "being an only child" as a covariate; it neither contributed to model fit nor changed parameter estimates substantially. It was thus excluded from analyses. All models tested had no negative error variances (error variances are not shown) or out-of-range covariances, indicating that the analyses had converged upon proper solutions.

Because it contained only two indicators (i.e., constant television and television during meals), the measurement model for the pervasiveness of television could not be evaluated separately from the structural model. In all models evaluated, both indicators loaded highly on the latent variable. Loadings ranged from .69 to .86 for "constant television" and .63 to .79 for "television during meals." It was concluded that the measurement model was sound and no further modifications were made. Recall that two models were proposed to test the age of first television-viewing: The availability of television was measured with the number of televisions in the home in Model A and with the presence of a television in the bedroom in Model B (see Figs. 2 and 3). Note that higher values for the dependent variable "age of first use" denote first use at a later age.

Model A

The proposed model showed a poor fit to the data, $\chi^2(18) = 134.15$, $p < .001$; RMSEA = .09, $p < .001$; IFI = .85; CFI = .84 (see top of Fig. 11). Seven of the 16 hypothesized structural paths were not significant (shown with dashed lines in Fig. 12). These nonsignificant paths were trimmed with no decrement to model fit, $\Delta\chi^2(7) = 9.15$, $p > .05$. Iterative examination of the modification indices resulted in the addition of three significant paths. One of the paths was a direct (i.e., unmediated) relation between household income and the pervasiveness of television. The remaining two paths represented direct linkages between parental education and rule-setting, and between the pervasiveness of television and rule-setting. Because gender was unrelated to other variables in the model, it was deleted. Beliefs about television was re-expressed as an exogenous variable because neither education nor income was associated with it.

Of the three paths added, the causal direction of the path between pervasiveness of television and rule-setting was ambiguous: It is possible that the pervasiveness of television interferes with parents' ability to regulate their children's viewing; conversely, the absence of parental rules about the amount of time children could spend with television could result in the television set being on regularly. The extant research could not inform decisions about the direction of causality. Therefore, a nonrecursive model testing the directionality of these relations was run (see bottom of Fig. 11). The model satisfied the conditions for identification, namely that there was

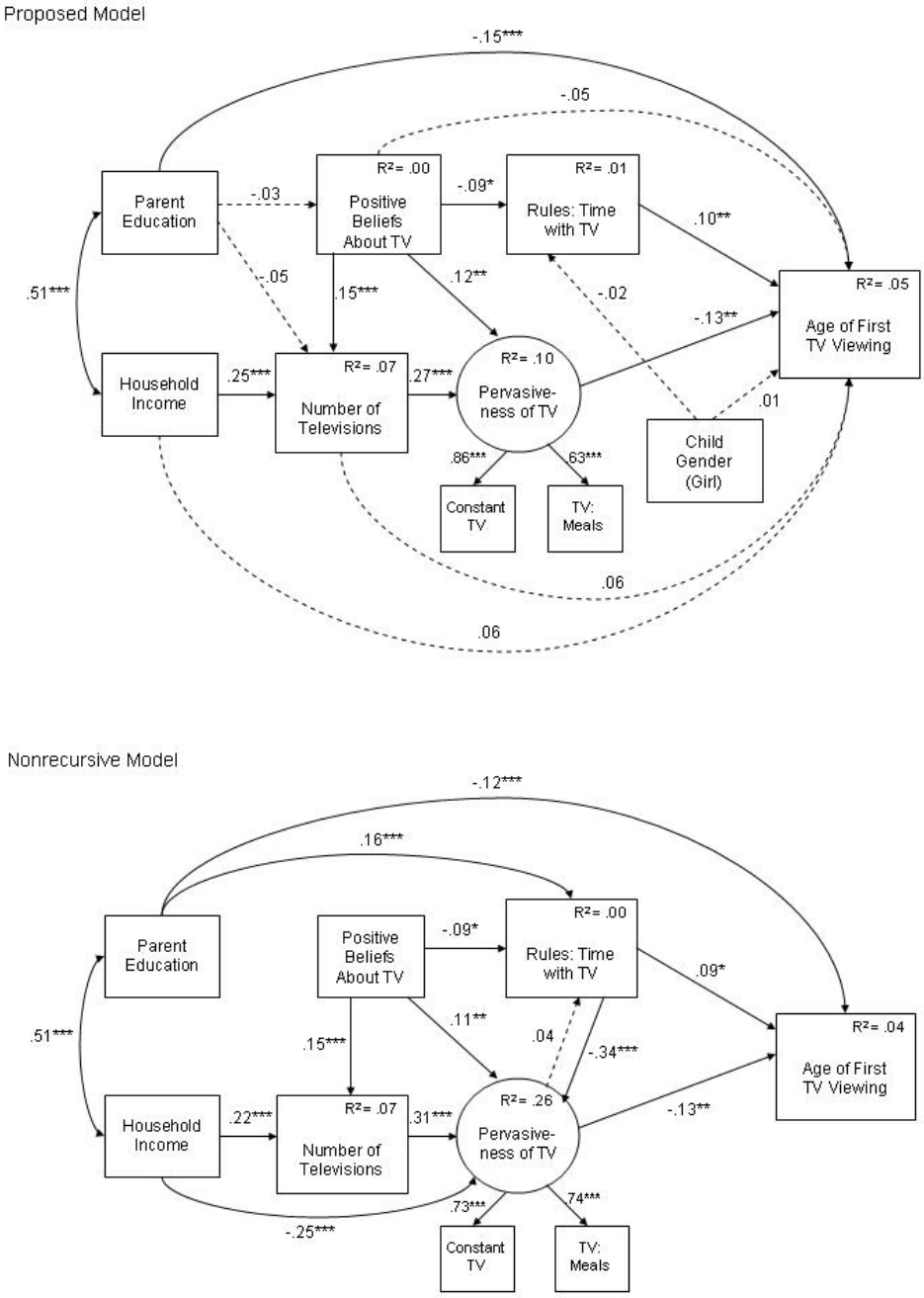


Figure 11. Proposed model A (top) predicting age of first television viewing. Dashed lines represent nonsignificant paths. Nonrecursive model (bottom) testing reciprocal relations between rule-setting and pervasiveness of television.

at least one instrumental variable (parent education/television in the bedroom) that significantly predicted one variable (rule setting/pervasiveness of television) but not the other (pervasiveness of television/rule setting). The resulting model was consistent with rule setting affecting the pervasiveness of television, not the other way around [see bottom of Fig. 11; $\chi^2(18) = 30.87$, $p < .03$; RMSEA = .03, $p = .96$; IFI = CFI = .98]. Thus, the path emanating from pervasiveness of television to rule-setting was removed.

The final model appears in Figure 12. The remaining paths continued to reach significance. Overall, consistent with the improvements to the model, fit indices indicated a good fit to the data, χ^2 (14) = 22.87, $p > .05$; RMSEA = .03, $p = .95$; IFI = CFI = .99. The model did not explain much variance in the dependent variable, however (R^2 = .04).

The final model (see Fig. 12) included several sets of paths through which sociodemographic and family factors were linked to age of first viewing, both directly and through intermediary effects. Parent education had both direct and indirect associations with the age at which children first watched television. Children whose parents had more education were likely to start viewing earlier than those whose parents had less education. Children with more highly educated parents were also more likely to have rules about viewing, which in turn predicted viewing at a later age. In addition to its direct relation, rule-setting was indirectly linked to the age of viewing through its negative relation with the pervasiveness of television in the home.

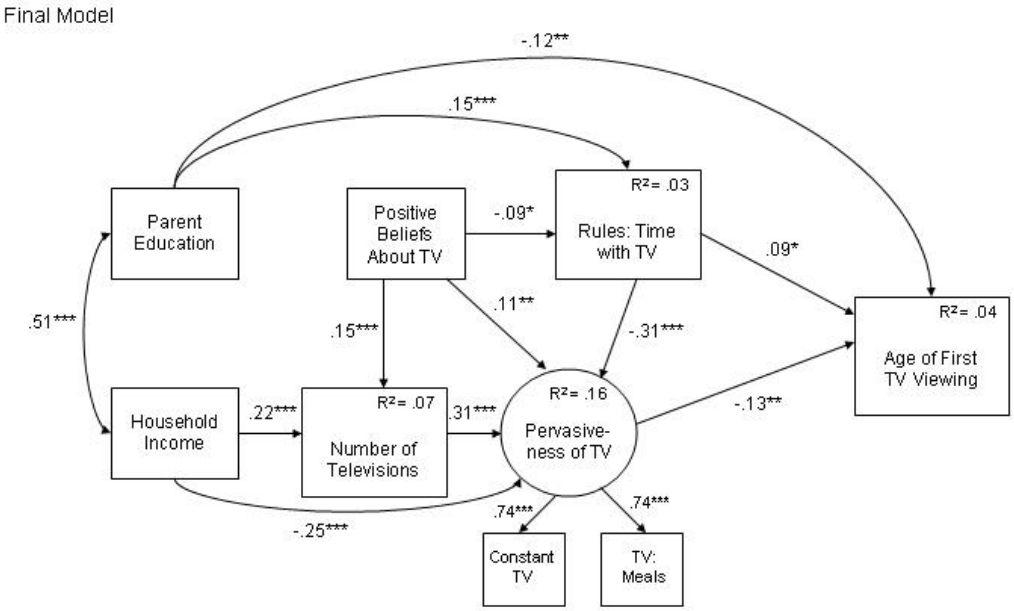


Figure 12. Final model A predicting age of first television viewing.

Income did not directly predict the age of first viewing. Rather, it operated through its relation with the home television environment: the number of television sets and the pervasiveness of television. Children in higher-income households had access to more television sets, which contributed to a pervasive-television environment, predicting viewing at an earlier age. Income was also directly—negatively—linked to the pervasiveness of television, indicating that the television set was left on more often in low-income households.

Parental education failed to predict parents' beliefs about television. Parental beliefs were linked to the age of first use via several mediating mechanisms. Children whose parents were more positive toward television were more likely to live in homes where there were no rules about viewing and where the television was more pervasive; both were associated with viewing at an earlier age; and those whose parents held positive beliefs lived in homes with more television sets, which, as previously described, predicted earlier viewing through its connection with television's pervasiveness in the home.

Multigroup analyses. Multigroup analyses were performed by age group (0-2, 3-4, and 5-6) and ethnicity (Black, Hispanic, and White) to test whether these characteristics moderated the associations specified in the model. Analyses showed that the model did not differ by age group or ethnicity across any of the parameters (see Table 10). The final model was therefore deemed to hold across age and ethnic groups.

Table 10

Results for Multigroup Analyses by Age Group Predicting Age of First Television Use (Model A)

	(df) χ^2 or Δ(df) χ^2	
	Age group	Ethnicity
Unconstrained model	(42) 62.427*	(42) 57.251
Constrained models:		
Measurement weights (Model 1)	(46) 62.903*	(46) 65.134*
Change from unconstrained model	Δ(4) .476	Δ(4) 7.883
Measurement weights & structural weights (Model 2)	(66) 87.018*	(66) 82.386
Change from Model 1	Δ(20) 24.115	Δ(20) 17.252
Measurement weights & structural weights & structural covariances (Model 3)	(74) 95.887*	(74) 96.397*
Change from Model 2	Δ(8) 8.869	Δ(8) 14.011
Measurement weights & structural weights & structural covariances & structural residuals (Model 4)	(80) 100.153	(80) 100.666
Change from Model 3	Δ(6) 4.266	Δ(6) 4.269

* $p < .05$

Model B

Using the presence of television in the bedroom as a measure of availability, Model B is shown in Figure 13. The hypothesized model fit the data poorly, χ^2 (19) = 157.18, $p < .001$; RMSEA = .10, $p < .001$; IFI = .81; CFI = .80. Of the 15 hypothesized paths, the six that were not significant were eliminated without affecting fit, $\Delta\chi^2(7) = 5.88$, $p > .05$. Iterative examination of the modification indices suggested an addition of four paths: (a) one representing a direct relation between parent education and rule-setting, (b) one depicting a relation between household income and pervasiveness of television, (c) one representing a direct relation between the pervasiveness of television and rule-setting, and (d) a path representing a link between a television in the bedroom and the pervasiveness of television. Child gender was unrelated to other variables in the model and was deleted. Beliefs about television was expressed as an exogenous variable. As with Model A, results supported a causal effect from rule-setting to the pervasiveness of television rather than the other way around (nonrecursive model is not presented; β for rule-setting → pervasiveness = -.37, $p < .001$; β for pervasiveness → rule setting = .07, $p > .05$). The former path was thus retained.

The final model is shown at the bottom of Figure 13. It fit the data well, χ^2 (13) = 11.48, $p = .57$; RMSEA = .00, $p = .99$; IFI = CFI = 1.00. The direction of effects and magnitude of most path coefficients were similar to those for Model A (see Fig. 12) and will not be discussed in detail. In addition to parent education, rule setting, and

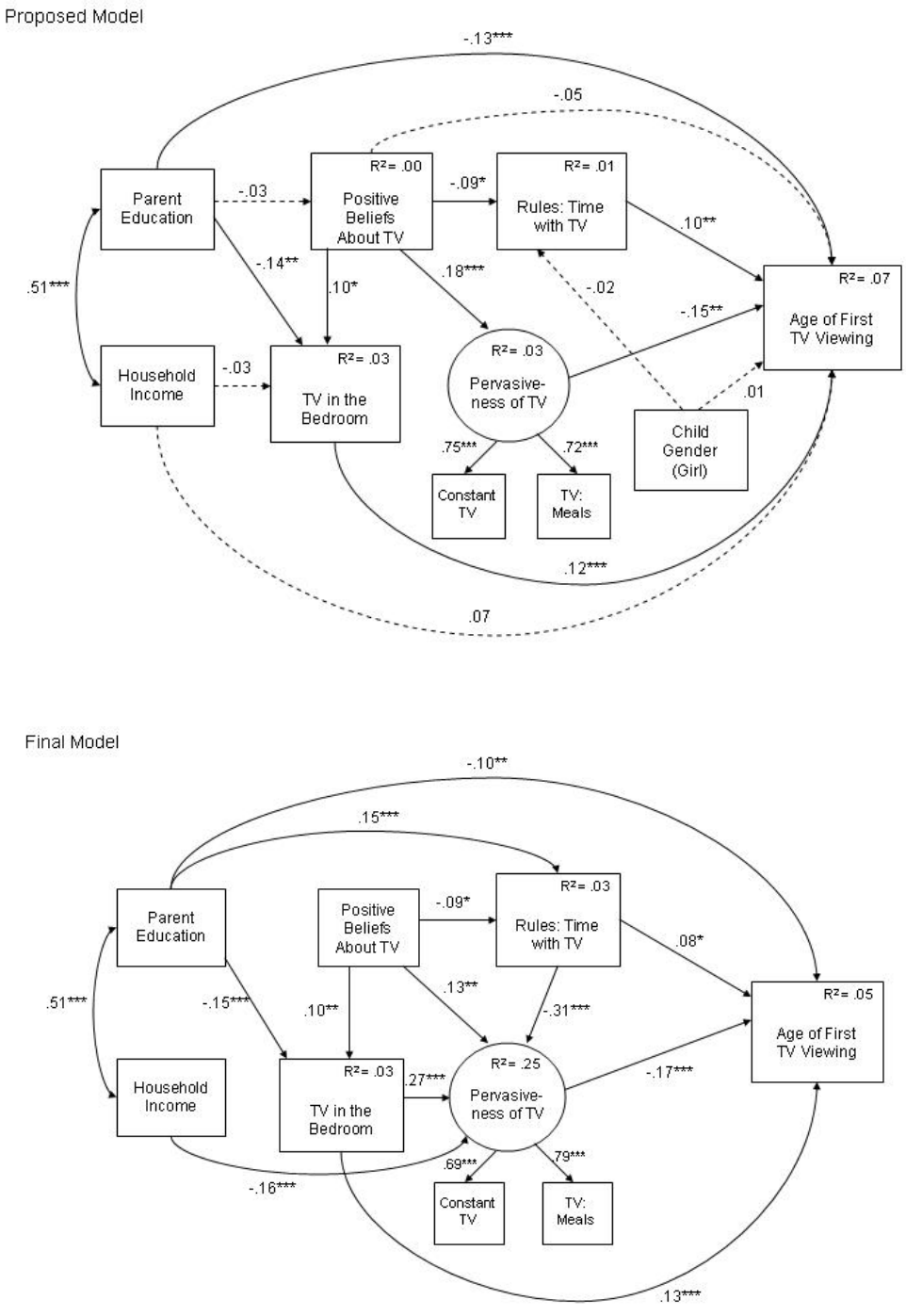


Figure 13. Proposed (top) and final (bottom) models B predicting the age of first television viewing. Dashed lines represent nonsignificant paths.

the pervasiveness of television, having a television in the bedroom directly predicted the age of first viewing. Children with a bedroom set started watching television at a later age. Parent education did not predict the number of televisions in the home (Model A, see Fig. 13) but it predicted the presence of a television in the child's room. Children whose parents were less educated were more likely to have a bedroom set. Those whose parents had positive beliefs about television were also more likely to have television in the room. Having a television in the bedroom contributed to a pervasive television environment, predicting viewing at a younger age.

Multigroup analyses. Multigroup analyses indicated that the model did not differ by age or ethnic group across any of the parameters (see Table 11); thus, the final model was equivalent across age groups and ethnicities.

Sociodemographic, Family, and Child Processes Predicting the Age at Which Children First Used a Computer

The descriptives for all measures can be seen in Table 12. Correlations among variables in the sample appear in Appendix B. The proposed model is shown at the top of Figure 14. It fit the data well, χ^2 (8) = 7.35, p = .50; RMSEA = .00, p = .92; IFI = CFI = 1.00, but only four paths were significant. The model was simplified by trimming nonsignificant paths, $\Delta \chi^2$ (8) = 8.82, $p > .05$. For parsimony, variables that did not contribute to the model—child gender, beliefs about computers, and rules about computers— were also deleted.

Table 11

Results for Multigroup Analyses by Age Group Predicting Age of First Television Use (Model B)

	(df) χ^2 or Δ(df) χ^2	
	Age group	Ethnicity
Unconstrained model	(39) 56.816*	(39) 38.992
Constrained models:		
Measurement weights (Model 1)	(43) 57.413	(43) 46.415
Change from unconstrained model	Δ(4) .597	Δ(4) 7.423
Measurement weights & structural weights (Model 2)	(65) 80.225	(65) 78.793
Change from Model 1	Δ(22) 22.812	Δ(22) 32.378
Measurement weights & structural weights & structural covariances (Model 3)	(73) 89.094	(73) 92.805
Change from Model 2	Δ(8) 8.869	Δ(8) 14.012
Measurement weights & structural weights & structural covariances & structural residuals (Model 4)	(79) 94.765	(79) 100.785
Change from Model 3	Δ(6) 5.671	Δ(6) 7.980

* $p < .05$

Table 12

Means and Standard Deviations for All Variables for the Computer Sample by Age Group

	Age groups						
	0-2 (n = 52)		3-4 (n = 171)		5-6 (n = 188)		
Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 391)
Parent education[a]	5.01	1.50	4.81	1.47	4.68	1.47	1.00
Household income[a]	4.26	1.84	4.58	1.47	4.60	1.61	.96
Parent ethnicity: Black	.10	.31	.14	.35	.13	.33	.19
Parent ethnicity: Hispanic	.17[a]	.38	.11	.32	.06[a]	.24	3.02*
Child gender (girl)	.53	.50	.52	.50	.49	.50	.35
Only child	.34	.48	.30	.46	.25	.44	1.06
Beliefs about computers[b]	2.84	.37	2.89	.36	2.84	.48	.68
Number of computers[c]	1.71	1.13	1.50	.92	1.58	1.09	.84
Rules: time with computers	.65	.48	.67	.48	.66	.47	.02

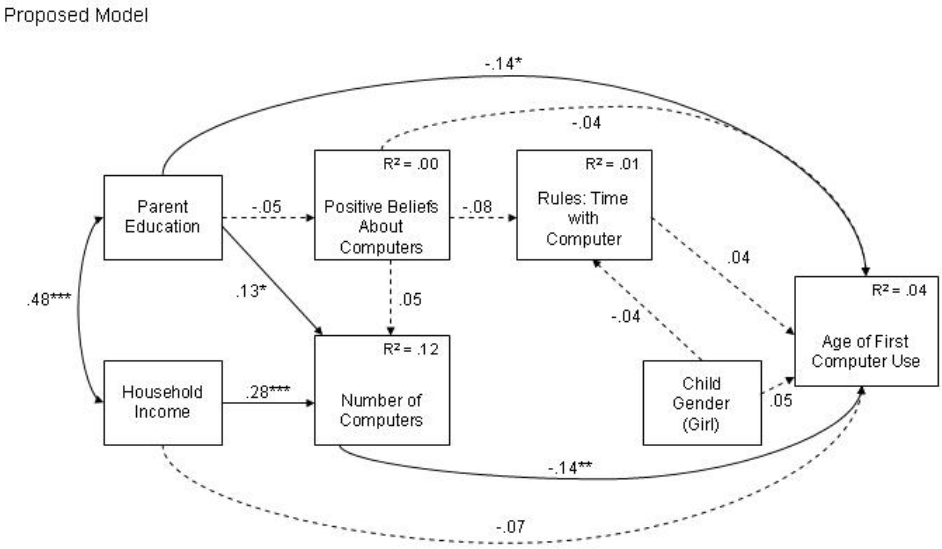
Table continues

	0-2		3-4		5-6		
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 391)
Age of first use (months)	15.87[ab]	6.79	28.85[bc]	9.47	41.95[cd]	13.98	119.02***
Time with computers (minutes)	9.98	20.28	17.93	30.98	22.64	46.11	.93

Note. Age groups that share the same superscript across rows are significantly different from each other at $p < .05$ according to Tukey's *HSD*.

a Range = 1-7; [b] Range = 1-3; [c] Range = 1-6

*** $p < .001$, ** $p < .01$, * $p < .05$



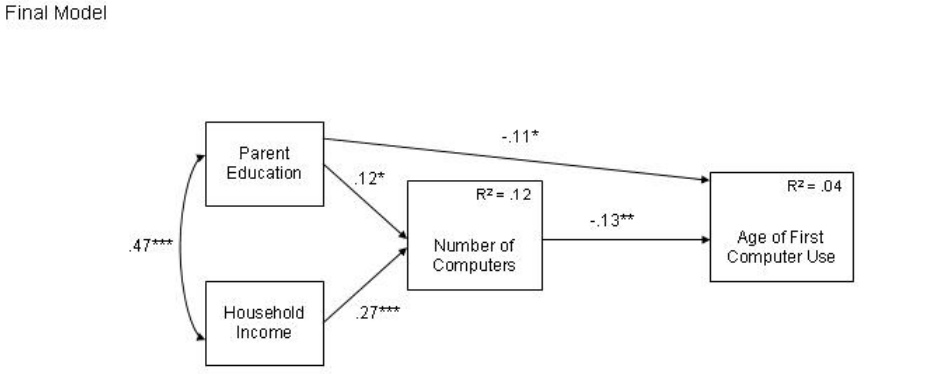


Figure 14. Proposed (top) and final (bottom) models predicting the age of first computer use. Dashed lines represent nonsignificant paths.

The final model appears at the bottom of Figure 14. It showed good fit to the data, χ^2 (1) = 1.24, p = .27; RMSEA = .03, p = .47; IFI = CFI = 1.00. The age at which children first used a computer was predicted by two variables (R^2 = .04): parental education and the availability of computers in the home. Children who had more highly educated parents and more computers at home first used a computer when they were younger. The number of computers was in turn positively associated with both parent education and income.

Multigroup analyses. Results from multigroup analyses are presented in Table 13. Models testing age-group differences showed no difference in structural weights and structural covariances between the groups. They did differ on structural residuals, suggesting that the model may have different predictive power for different age groups. An examination of the residuals revealed that the nonzero residuals were positive for the 0 to 2 and 3 to 4 age groups but negative for 5- to 6-year-olds, indicating that the model was overpredicting for some groups and underpredicting for others. Given that these deviations were minor (none exceeded the recommended value standardized of 2), and that the age groups did not differ on structural weights or structural covariances, the same model was retained for the three age groups.

Multigroup analyses of ethnicities indicated that the two groups had the same structural weights but different structural covariances (see Table 13). Examinations of the variance-covariance matrix for each group indicated that variances and covariances were larger for Black and Hispanic children than it was for children of

Table 13

Results for Multigroup Analyses by Age Group Predicting Age of First Computer Use

	(df) χ^2 or Δ (df) χ^2	
	Age group	Ethnicity
Unconstrained model	(3) 9.265*	(2) 1.262
Constrained models:		
Structural weights (Model 1)	(11) 17.794	(6) 4.338
Change from unconstrained model	Δ(8) 8.529	Δ(4) 3.076
Structural weights & structural covariances (Model 2)	(17) 29.992*	(9) 15.726*
Change from Model 1	Δ(6) 12.198	Δ (3) 11.388**
Structural weights & structural Covariances & structural residuals (Model 3)	(21) 74.132	--
Change from Model 2	Δ(15) 33.140*	--

*** $p < .001$, * $p < .05$

White and "other" ethnicities (e.g., covariance between parent education and income: Black and Hispanic children = 1.30, *SE* = .32, *r* = .48; White and "other" children = .96, *SE* = .13, *r* = .46). Thus, the relation between income and education was stronger for Black and Hispanic children than for White children. The model was re-estimated separately for the two groups to examine the differences in magnitude of the coefficients that might result from unequal structural covariances (models are not shown here). Inspection of the path coefficients showed that their relative magnitudes were similar within each ethnic group. Thus, it was concluded that although the groups did not have equivalent structural covariances, this difference was not substantial, and given that the two groups did not differ on structural weights or structural residuals [compared with unconstrained model: $\Delta\chi^2$ (2) = 3.04, $p > .05$)], the final model was deemed to be consistent across ethnic groups.

Time Spent Using Television and Computers

The descriptive statistics for the amount of time children spent using television and computers are shown in Tables 7 and 10 respectively. As expected, children spent substantially more time watching television than they did using a computer. The age groups in this sample did not differ on how much television they watched. There appeared to be a trend toward spending more time with computers among older age groups, but these differences were not statistically significant.

Age differences did emerge if all children—both users and nonusers—were examined. For television viewing, 0- to 2-year-olds watched less television than did 3-

to 4- and 5- to 6-year-olds. Three- to four-year-and 5- to 6-year-olds watched equivalent amounts [ages 0-2 (n =397): M = 56.58, SD = 72.83; ages 3-4 (n = 351): M = 74.83, SD = 70.55; ages 5-6 (n = 292): M = 65.10, SD = 62.71; $F(2, 1039) = 15.23$, $p < .05$]. Time spent on computer use was greater among older children; the oldest children spent the most time using a computer, followed by the middle age group, then the youngest [ages 0-2 (n = 402): M = 2.22, SD = 12.00; ages 3-4 (n = 345): M = 11.70, SD = 36.77; ages 5-6 (n = 283): M = 17.50, SD = 43.83; $F(2, 1027) = 35.22$, $p < .05$].

Sociodemographic, Family, and Child Processes Predicting Time Spent Watching Television

Model A

The initial hypothesized model demonstrated poor fit with the data; χ^2 (18) = 133.92, $p < .001$; RMSEA = .09, $p < .001$; IFI = .86; CFI = .85 (see top of Fig. 15). Six paths that did not contribute to the model were trimmed. Examination of modification indices suggested three additional paths. As with the models predicting age of first television viewing, three paths were added from (a) parent education to rule setting, (b) rule setting to the pervasiveness of television, and (c) household income to pervasiveness of television.

The resulting model allowed for the testing of reciprocal relations between the time children spent watching television and the pervasiveness of television in the home, proposed in Figure 2. The nonrecursive model can be seen at the bottom of Figure 15, χ^2 (13) = 22.18, p = .05; RMSEA = .03, p = .96; IFI = CFI = .99. Findings suggested that with the pervasiveness of television affected the amount of time

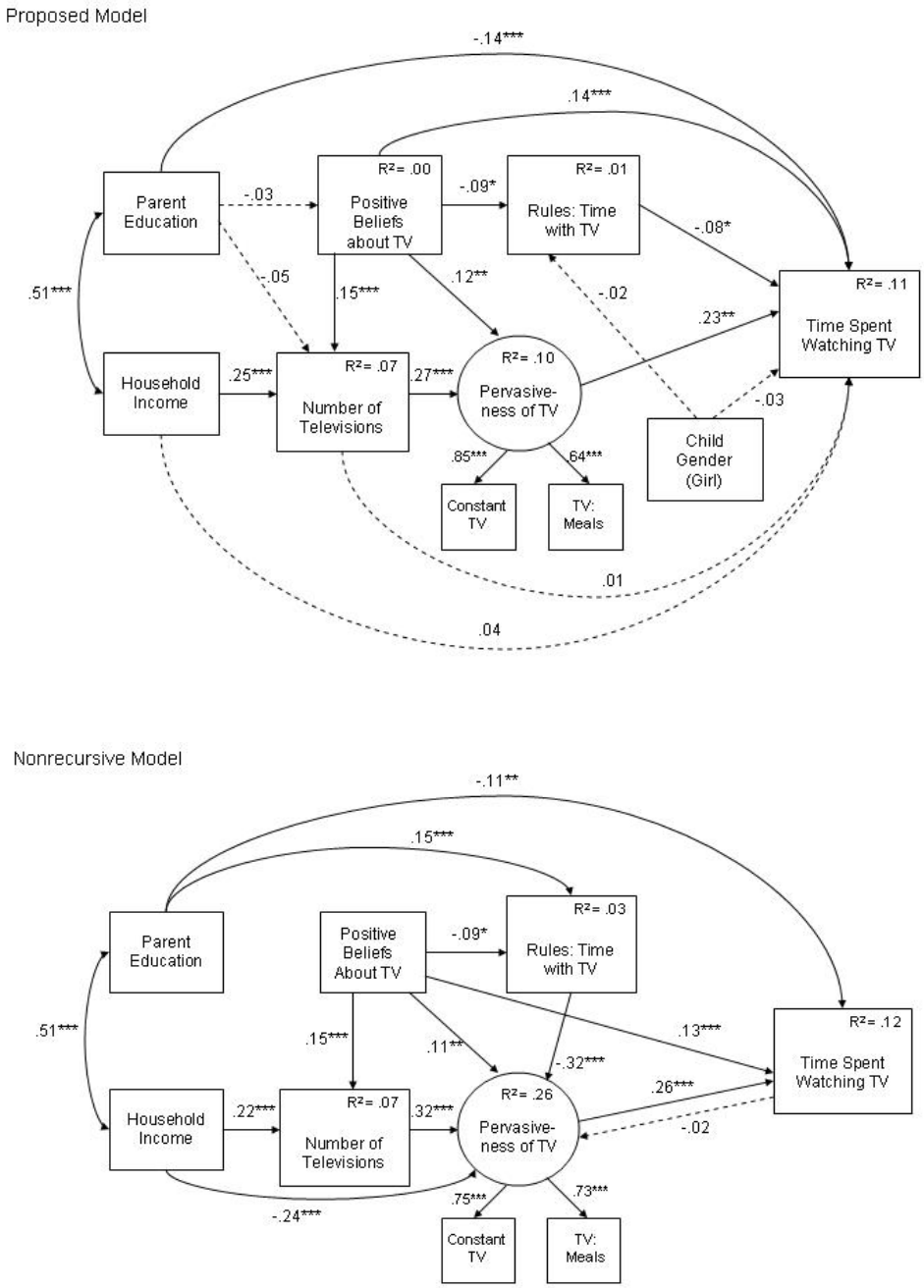


Figure 15. Proposed model A (top) predicting time spent watching television. Dashed lines represent nonsignificant paths. Nonrecursive model (bottom) testing reciprocal relations between children's viewing and the pervasiveness of television.

children spent watching television, but children's viewing did not contribute to a pervasive television environment. The path depicting the latter was thus removed from the model.

The final model is shown in Figure 16. Fit indices indicated good fit with the data, χ^2 (14) = 22.24, p = .07; RMSEA = .03, p = .96; IFI = CFI = .99. The model accounted for 12% of variance in the time children spent watching television. Three variables directly predicted how much television children watched: parent education, parents' beliefs about television, and the pervasiveness of television in the home. Children whose parents were more highly educated spent less time watching television. Parent education also had indirect effects on children's viewing: Children whose parents had more education were more likely to set rules about viewing, which in turn reduced the pervasiveness of television in the home; children in homes where the television was less pervasive watched less television.

Parents' beliefs about television had direct and indirect associations with how much television children watched. Children whose parents had positive beliefs watched more television. Having positive beliefs was directly linked to the pervasiveness of television of television in the home; it was also indirectly associated with pervasiveness through its relation with the number of televisions: Parents with positive beliefs about television provided more television sets in the home. Parents who had positive beliefs were less likely to set rules about viewing, and the absence of rules contributed to a pervasive television environment.

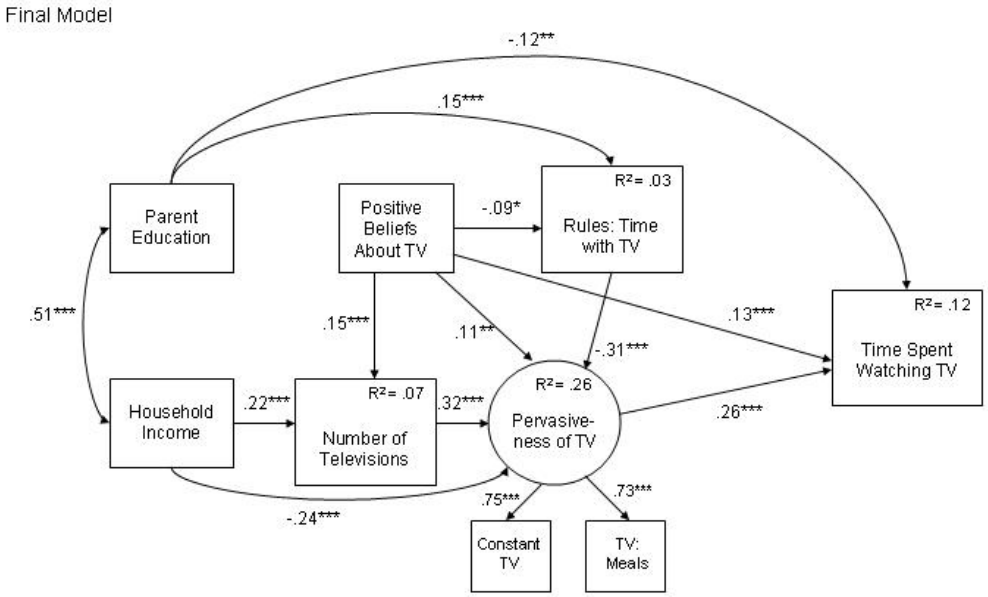


Figure 16. Final model A predicting time spent watching television

Multigroup analyses. The final model was tested across age group and ethnicity. Multigroup analyses revealed no differences among the ethnic groups for any of the parameters tested (see Table 14).

Analyses of age-group differences showed that the groups differed in measurement weights (see Table 14). Follow-up tests indicated that 3- to 4-year-olds were different from 0- to 2- and 5- to 6-year-olds (see top half of Table 15). The 0- to 2- and 5- to 6-year olds were equivalent on all parameters tested. Further analyses were conducted to determine whether, apart from measurement weights, the age groups (0-2 vs. 3-4 and 3-4 vs. 5-6) were different on other parameters (structural weights, structural covariances, and structural residuals). Multigroup analyses indicated that the two pairs of age groups were invariant on all parameters other than measurement weights (see bottom of Table 15).

Examinations of the unconstrained measurement loadings showed only slight variation in loadings (ages 0-2: $\lambda_{constantTV} = .70$, $\lambda_{TVmeals} = .68$; ages 3-4: $\lambda_{constantTV} = .76$, $\lambda_{TVmeals} = .75$; ages 5-6: $\lambda_{constantTV} = .83$, $\lambda_{TVmeals} = .70$). In this case, while the stringent criterion of metric invariance (i.e., strict equivalence) of factor loadings could not be satisfied, configural invariance (Horn & McArdle, 1992) still holds: Loadings for all age groups were high and in the anticipated direction and in all cases the loadings for "constant television" were higher than those for "television during meals." The latent factor measured the same attribute for all age groups and was invariant in previous models tested. Thus, it was concluded that the variations in factor loadings were not

Table 14

Results for Multigroup Analyses by Age Group Predicting Time Spent Viewing Television (Model A)

	(df) χ^2 or Δ(df) χ^2	
	Age group	Ethnicity
Unconstrained model	(42) 66.633**	(42) 52.565
Constrained models:		
Measurement weights (Model 1)	(46) 78.499**	(46) 57.028
Change from unconstrained model	Δ(4) 11.866*	Δ(4) 4.463
Measurement weights & structural weights (Model 2)	--	(66) 72.781
Change from Model 1	--	Δ(20) 15.753
Measurement weights & structural weights & structural covariances (Model 3)	--	(74) 86.792
Change from Model 2	--	Δ(8) 14.011
Measurement weights & structural weights & structural covariances & structural residuals (Model 4)	--	(80) 90.927
Change from Model 3	--	Δ(6) 4.135

* $p < .05$

Table 15

Results for Multigroup Analyses Testing Differences among Age Groups in Time Spent Viewing Television (Model A)

	(df) χ^2 or Δ(df) χ^2		
	0-2 vs. 3-4	3-4 vs. 5-6	0-2 vs. 5-6
Unconstrained model	(28) 42.584*	(28) 39.054	(28) 51.627**
Constrained models:			
Measurement weights (Model 1)	(30) 51.919**	(30) 46.343*	(30) 52.603**
Change from unconstrained model	Δ(2) 9.335*	Δ(2) 7.289*	Δ(2) .976
Measurement weights & structural weights (Model 2)	--	--	(40) 64.853**
Change from Model 1	--	--	Δ(10) 12.250
Measurement weights & structural weights & structural covariances (Model 3)	--	--	(44) 70.311**
Change from Model 2	--	--	Δ(4) 5.458
Measurement weights & structural weights & structural covariances & structural residuals (Model 4)	--	--	(47) 74.253**
Change from Model 3	--	--	Δ(3) 3.942
Unconstrained model	(28) 42.584*	(28) 39.054	--
Constrained models:			
Structural weights (Model 1)	(38) 54.911*	(38) 51.059	--
Change from unconstrained model	Δ(10) 12.327	Δ(10) 12.005	--

Table continues

	(df) χ^2 or Δ(df) χ^2		
	0-2 vs. 3-4	3-4 vs. 5-6	0-2 vs. 5-6
Structural weights & structural covariances (Model 2)	(42) 61.322*	(42) 52.288	--
Change from Model 1	Δ(4) 6.411	Δ(4) 1.229	--
Structural weights & structural covariances & structural residuals (Model 3)	(45) 63.831*	(45) 52.611	--
Change from Model 2	Δ(3) 2.509	Δ(3) .323	--

** $p < .01$, * $p < .05$

substantively or conceptually meaningful, and that the measurement model is essentially invariant across age groups. The final model was regarded as being equivalent across age groups.

Model B

The proposed model appears in the top portion of Figure 17. It showed poor fit to the data, χ^2 (19) = 157.49, $p < .001$; RMSEA = .10, $p < .001$; IFI = .82, CFI = .81. Six of the paths that failed to reach significance were removed from the model. Four paths were added between (a) parent education and rule setting, (b) rule setting and the pervasiveness of television, (c) household income and the pervasiveness of television, and (d) television in the bedroom and pervasiveness of television.

As with Model A, the reciprocal relation between the pervasiveness of television and children's viewing was tested (model is not shown here). The same conclusion was reached: Children's viewing did not play a role in creating a pervasive television environment, but the pervasiveness of television predicted how much television children watched (β for pervasiveness of television → time spent viewing = .22, $p < .001$; β for time spent viewing → pervasiveness of television = .03, $p > .05$). The nonsignificant path was trimmed from the model.

The final model is shown in the bottom of Figure 17. While household income predicted the number of televisions in the home (Model A), it did not predict the presence of television in the bedroom; rather, children whose parents had less education were more likely to provide their child with a bedroom set than were those

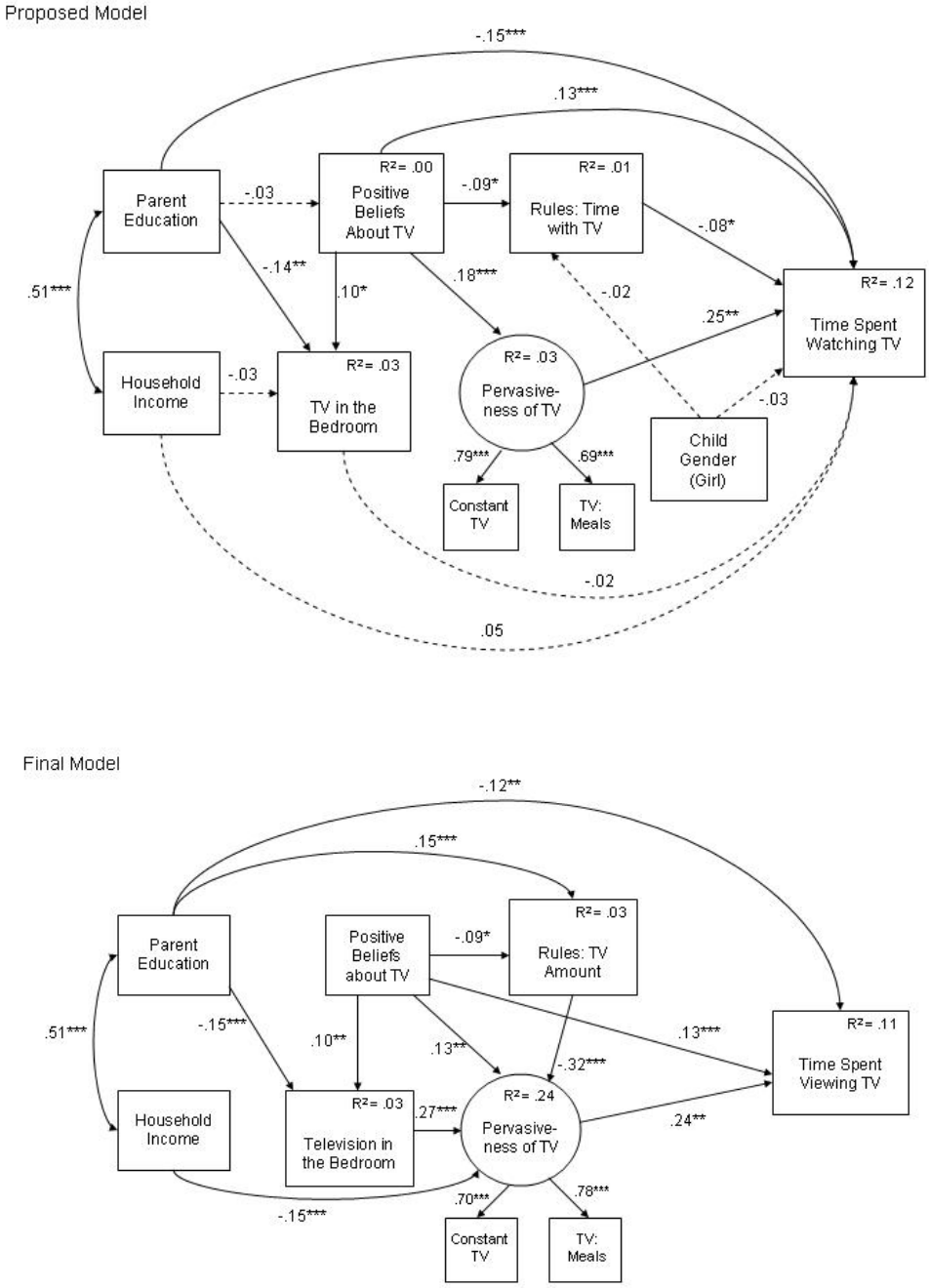


Figure 17. Proposed (top) and final (bottom) models B predicting time spent watching television. Dashed lines represent nonsignificant paths.

with more education. Having a television set in the bedroom was linked to greater pervasiveness of television in the home. The remaining paths were similar to those in Model A and will not be discussed in detail.

Multigroup analyses. Results from multigroup analyses are presented in Table 16. The three ethnic groups were equivalent on all parameters tested. Analyses of differences among age groups showed that they did not have equivalent measurement weights (see Table 16). Analyses comparing each pair of age groups revealed that the 0- to 2-year-olds were different from the 3- to 4-year-olds (see Table 17). Further tests indicated that these two groups did not differ in structural weights, structural covariances, or structural residuals (see bottom of Table 17). An examination of the factor loadings led to conclusions similar to those for Model A. Small variations in loadings (ages 0-2: $\lambda_{constantTV} = .68$, $\lambda_{TVmeals} = .70$; ages 3-4: $\lambda_{constantTV} = .74$, $\lambda_{TVmeals} = .77$; ages 5-6: $\lambda_{constantTV} = .72$, $\lambda_{TVmeals} = .80$) pointed to configural invariance but not metric invariance. Because loadings were high and the factor measured the same construct across all age groups, it was concluded that these minor variations in loadings did not necessitate separate models for each age group, and that the final model operated for all ages.

Sociodemographic, Family, and Child Processes Predicting Time Spent Using the Computer

As shown in the top of Figure 18, the proposed model fit the data well, χ^2 (8) = 7.35, $p = .45$; RMSEA = .00, $p = .92$; IFI = CFI = 1.00. Of the 12 hypothesized paths, seven did not reach significance. Deleting them from the model did not result in detriment

Table 16

Results for Multigroup Analyses by Age Group Predicting Time Spent Viewing Television (Model B)

	(df) χ^2 or Δ(df) χ^2	
	Age group	Ethnicity
Unconstrained model	(42) 77.512**	(42) 47.363
Constrained models:		
Measurement weights (Model 1)	(46) 87.321**	(46) 53.121
Change from unconstrained model	Δ(4) 9.809*	Δ(4) 5.758
Measurement weights & structural weights (Model 2)	--	(66) 82.681
Change from Model 1	--	Δ(20) 29.560
Measurement weights & structural weights & structural covariances (Model 3)	--	(74) 96.693*
Change from Model 2	--	Δ(8) 14.012
Measurement weights & structural weights & structural covariances & structural residuals (Model 4)	--	(80) 105.027*
Change from Model 3	--	Δ(6) 8.334

* $p < .05$

Table 17

Results for Multigroup Analyses Testing Differences Among Age Groups in Time Spent Viewing Television (Model B)

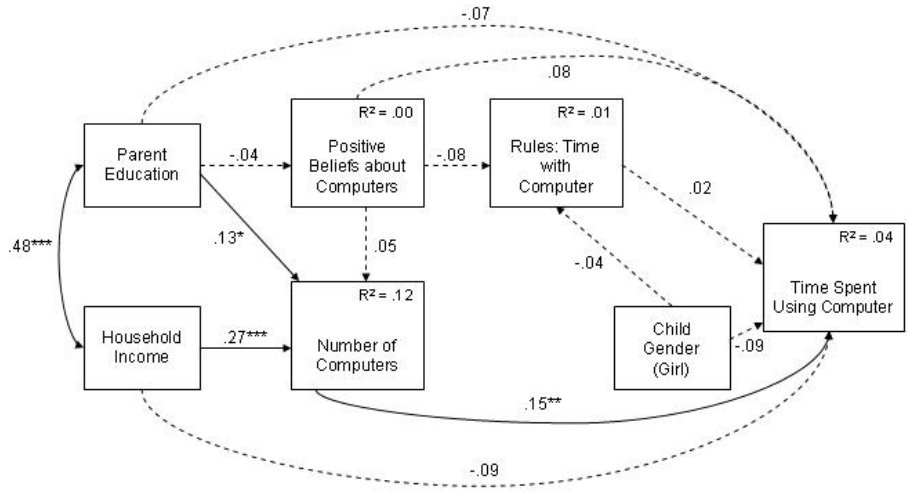
	(df) χ^2 or Δ(df) χ^2		
	0-2 vs. 3-4	3-4 vs. 5-6	0-2 vs. 5-6
Unconstrained model	(28) 42.852*	(28) 52.972**	(28) 59.199**
Constrained models:			
Measurement weights (Model 1)	(30) 52.577**	(30) 56.083**	(30) 61.070**
Change from unconstrained model	Δ(2) 9.725*	Δ(2) 3.111	Δ(2) 1.871
Measurement weights & structural weights (Model 2)	--	(40) 70.785**	(40) 71.121**
Change from Model 1	--	Δ(10) 14.702	Δ(10) 10.051
Measurement weights & structural weights & structural covariances (Model 3)	--	(44) 72.014**	(44) 76.579**
Change from Model 2	--	Δ(4) 1.229	Δ(4) 5.458
Measurement weights & structural weights & structural covariances & structural residuals (Model 4)	--	(47) 72.285*	(47) 80.433**
Change from Model 3	--	Δ(3) .271	Δ(3) 3.854
Unconstrained model	(28) 42.852*	--	--
Constrained models:			
Structural weights (Model 1)	(38) 49.321	--	--

Table continues

	(df) χ^2 or Δ(df) χ^2		
	0-2 vs. 3-4	3-4 vs. 5-6	0-2 vs. 5-6
Change from unconstrained model	Δ(10) 6.469	--	--
Structural weights & structural covariances (Model 2)	(42) 55.732	--	--
Change from Model 1	Δ(4) 6.411	--	--
Structural weights & structural covariances & structural residuals (Model 3)	(45) 59.487	--	--
Change from Model 2	Δ(3) 3.765	--	--

** $p < .01$, * $p < .05$

Proposed Model



Final Model: Age Groups

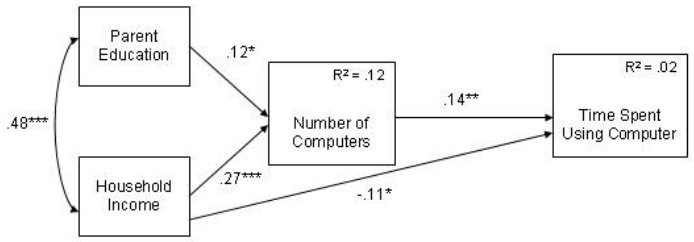


Figure 18. Proposed model (top) predicting time spent using a computer. Dashed lines represent nonsignificant paths. Final model (bottom) predicting time spent using a computer; model is equivalent across age groups.

to fit, $\Delta\chi^2$ (8) = 13.19, $p > .05$. Examination of the modification indices did not suggest the addition of any path.

The final model is displayed at the bottom of Figure 18, χ^2 (1) = 1.17, $p = .28$; RMSEA = .02, $p = .48$; IFI = CFI = .99. The key variables directly related to the amount of time children spent using the computer were household income and the number of computers: Those who had more computers at home spent more time using it, but those in higher-income homes spent less time on the computer. The availability of computers was in turn associated with income and parent education.

Multigroup Analyses

Analyses of differences by age group revealed that structural weights, structural covariances, and structural residuals were equivalent among the three age groups (see Table 18). The model displayed in Figure 18 was thus consistent for all age groups.

Analyses of differences by ethnicity showed that the structural weights were not equivalent between Black and Hispanic, and White children (see Table 18). Further tests showed that structural covariances also differed between the two groups [compared with the unconstrained model: $\Delta\chi^2$ (3) = 11.39, $p < .05$]. The original proposed model (top panel, Fig. 18) was therefore re-estimated separately by ethnicity. The final models derived for each group appear in Figure 19 [Black and Hispanic children: χ^2 (3) = 3.33, $p = .34$; RMSEA = .04, $p = .44$; IFI = CFI = .99; White children: χ^2 (3) = 5.86, $p = .20$; RMSEA = .06, $p = .36$; IFI = CFI = .97].

Table 18

Results for Multigroup Analyses by Age Group Predicting Time Spent Using the Computer

	(df) χ^2 or Δ (df) χ^2	
	Age group	Ethnicity
Unconstrained model	(3) 3.401	(2) 2.384
Constrained models:		
Structural weights (Model 1)	(11) 10.867	(6) 15.107
Change from unconstrained model	Δ(8) 7.466	Δ(4) 12.723*
Structural weights & structural covariances (Model 2)	(17) 12.065	--
Change from Model 1	Δ(6) 12.198	--
Structural weights & structural Covariances & structural residuals (Model 3)	(21) 31.972	--
Change from Model 2	Δ(4) 9.907	--

*** $p < .001$

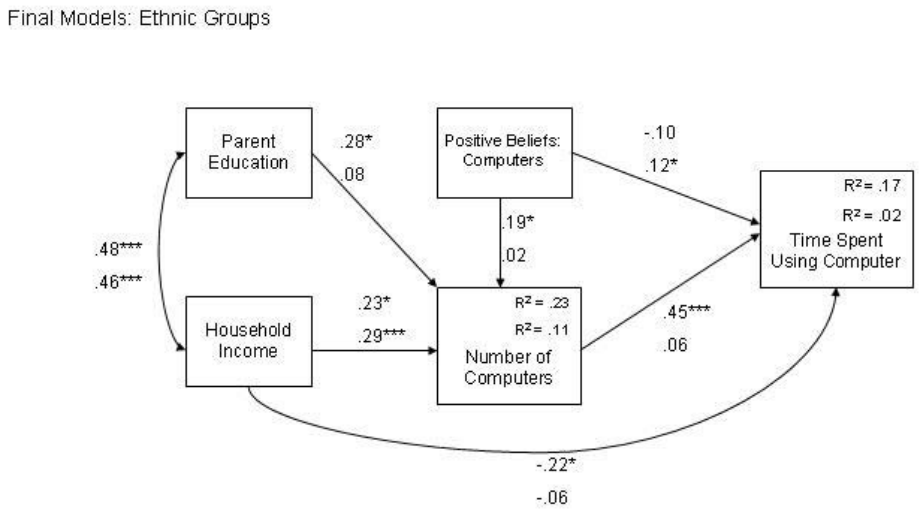


Figure 19. Final model for predicting time spent using a computer by ethnic groups. Coefficients on top denote those for Black and Hispanic children; coefficients at the bottom denote those for children of White and "other" ethnicities.

For Black and Hispanic children, income and availability were the main predictors of use. Those who lived in higher-income homes spent less time using computers than those in less wealthy; children who had more computers at home used it more than those who had fewer computers. The availability of computers was in turn positively related to parent education, income, and parental beliefs about computers. The model succeeded in explaining 17% of the variation in computer use. It fared more poorly for White children, however ($R^2 = .02$). Among White children, parental beliefs was the only direct predictor of time spent: Children whose parents had more positive beliefs about computers spent more time using them than did those whose parents had less positive beliefs.

Relation between Age of First Use and Time Spent Using Television and Computers

Tobit regressions were used to assess whether children who started using either television or computers at an earlier age spent more time with it. Analyses showed that the addition of the second block of interaction terms did not improve the model. Therefore, Model 1 will be interpreted. Results indicated that how early children started watching television (see Table 19) or using a computer (see Table 20) were unrelated—either linearly or nonlinearly – to how much time they spent using these media after controlling for sociodemographic characteristics and the family media ecology.

Table 19

Results from Tobit Regressions Testing Relation between Age of First Use and Time Spent with Television

	Model 1		Model 2	
Predictors	*B*	*SE*	*B*	*SE*
Sociodemographic factors				
Parent education	-.216***	.060	-.213***	.059
Household income	.068	.060	.067	.059
Ethnicity: Black	.500	.242	.447	.251
Ethnicity: Hispanic	.420	.222	.426	.223
Family TV ecology				
Beliefs about TV	.421***	.107	.424***	.107
Number of TVs	.064	.079	.065	.080
TV in the bedroom	-.297	.188	-.292	.188
Constant TV	.285***	.081	.284***	.081
TV during meals	.058	.053	.056	.052
Rules: Time with TV	-.409*	.175	-.410*	.175
Child characteristics				
Child gender (girl)	-.176	.165	-.189	.164
Child age	.112*	.052	.114	.053
Age of first use	-.104	.080	-.086	.093
Square of age of first use	-.024	.047	-.042	.050

Table continues

	Model 1		Model 2	
	B	*SE*	*B*	*SE*
Age first use x parent education	--	--	-.073	.055
Age first use x income	--	--	.069	.052
Age first use x Black	--	--	-.208	.228
Age first use x Hispanic	--	--	.025	.189
(df) Wald χ^2	(14) 97.92***		(18) 100.50***	
Δ(df) Wald χ^2	--		Δ(4) 2.58	

Note. Television $N = 750$ (167 censored, 583 uncensored)

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 20

Results from Tobit Regressions Testing Relation between Age of First Use and Time Spent with Computers

	Model 1		Model 2	
Predictors	*B*	*SE*	*B*	*SE*
Sociodemographic factors				
Parent education	-.196	.207	-.182	.207
Household income	-.283	.195	-.301	.197
Ethnicity: Black	1.260	.773	1.317	.768
Ethnicity: Hispanic	-.676	.936	-.685	.935
Family computer ecology				
Beliefs about computers	1.170	.722	1.056	.720
Number of computers	.686**	.242	.694**	.246
Rules: Time with computers	.238	.560	.235	.558
Child characteristics				
Child gender (girl)	-.974	.520	-1.030	.521
Child age	-.044	.255	-.027	.260
Age of first use	.302	.296	.387	.329
Square of age of first use	-.074	.139	-.109	.148
Age first use x parent education	--	--	-.118	.177
Age first use x income	--	--	.017	.148
Age first use x Black	--	--	-.517	.649

Table continues

	Model 1		Model 2	
Age first use x Hispanic	--	--	-.017	.701
(df) Wald χ^2	(11) 25.33**		(15) 26.48*	
Δ(df) Wald χ^2	--		Δ(4) 1.15	

Note. Computer N = 411 (272 censored, 139 uncensored)

*** $p < .001$, ** $p < .01$, * $p < .05$

Summary of Results

When Children First Used Television and Computers

Cohort differences were marked in the age at which children first watched television. A substantially greater proportion of children in the youngest cohort (0-2) had watched television before they were a year old compared with those in the older cohorts (3-4 and 5-6). Computer use was more likely to start prior to age 2 in the youngest cohort compared to other cohorts.

Event history analyses revealed that sociodemographic factors and the family media ecology were related to whether and when children started watching television and using a computer. Television viewing was more prevalent than computer use, and children started watching television earlier than they started using a computer. On average, television viewing began between the ages of 1 and 2, whereas computer use began when children were 4 to 5 years old. Sociodemographic characteristics—in particular, parent education and ethnicity—were related to the onset of use. Children whose parents had more education watched television and used a computer earlier than did those whose parents had less education. The relations between first use and ethnicity differed depending on the medium under consideration. Black children were especially likely to start watching television at every year throughout the first 7 years of life than were non-Black children. Hispanic children were less likely to use the computer than were non-Hispanic children.

The family media ecology was further predictive of the onset of media use. Parental beliefs were important predictors for both media: Children whose parents had negative beliefs were the least likely to initiate use at every period examined. Pervasiveness of television increased the likelihood of viewing, and having more computers in the home increased the likelihood of use.

In the structural equation models, several proposed paths were not supported. Income, parental beliefs and gender were not directly related to how early children started watching television. Paths that were not predicted included the influence of income on the pervasiveness of television, the direct effect of parent education on regulation, and the contribution of regulation and a television in the bedroom to a pervasive television environment.

Income was primarily related to the availability and pervasiveness of television in the home whereas parental education was mainly linked to the regulation of television. Education also directly predicted earlier viewing. Beliefs about television was associated with both the television environment (i.e., availability and pervasiveness) and regulation; what predicts beliefs is unknown, however. Comparisons of Models A and B uncovered different relations between socioeconomic variables and aspects of television access: The number of televisions was related to household income but not parental education, whereas the presence of television in the child's room was predicted by parent education but not income. Both measures of availability contributed to a pervasive television environment. Overall, children were

more likely to watch television earlier if they had parents with more education, had rules about television viewing, did not have a television in the bedroom, and lived in a pervasive television environment.

By contrast, fewer variables were significant in predicting when computer use began. The main predictors of how early children used a computer were parent education and the number of computers in the home: Children with more highly educated parents and more computers at home first used a computer earlier. Substantive age- and ethnic-group differences were not found for any of the models.

Time Spent Using Television and Computers

The processes predicting how much time children spent watching television were largely similar to those predicting how early they did so. The key differences were that parental beliefs directly predicted time spent but not the age of first use, whereas having a television in the bedroom and having rules about viewing predicted the age of first use but not time spent. Children who had parents with less education and positive beliefs about television, and who lived in a pervasive television environment watched more television. The same processes operated in all age and ethnic groups.

The primary predictors of time spent using computers were income and availability. Age differences were not found in this model, but ethnic-group differences necessitated the development of separate models for different ethnic groups. Differences emerged such that parental beliefs were the main predictor of

White children's computer use; among Black and Hispanic children, the amount of use was directly related to income and the number of computers at home; the latter was in turn associated with parental education, income, and parents' beliefs about computers.

Relation between Age of First Use and Amount of Use

No connection was found between how early children used television or computers and how much time they spent using these media.

DISCUSSION

The findings from this study add to our understanding of young children's media use and the sociodemographic and family contexts that surround it. Television and computers enter children's lives at an early age. Cohort differences were evident in how early children used these media. Television viewing was more likely to occur at a younger age (prior to 1 year old) for children in the youngest cohort compared to older children, confirming earlier findings that young children are more likely to watch television than they did in the past (Anderson & Pempeck, in press). Similarly, greater proportions of children in the youngest cohort used a computer before age 2 than did those in the older cohorts. Overall, these findings support the notion that electronic media are entering children's lives at increasingly early ages. Longitudinal data are needed to fully examine cohort changes.

Older children were likely to spend more time with both media than were younger children, but that was only if all children—both users and nonusers—were taken into account. Among young children who have already started using television and computers, there was a remarkable absence of age differences in the amount of time children spent with these media.

Television Viewing

Television viewing was considerably more prevalent than computer use, and children watched television much earlier than they used computers. Both sociodemographic factors and the family media ecology proved to be important

considerations in examining how early television viewing began, whereas child-level factors were not associated with viewing.

Several variables known to predict how much television children watched were also related to how early children started watching television. Researchers have established that Black children (Bickham et al., 2003; Blosser, 1988; Roberts et al., 1999; Tangney & Feshbach, 1988) and children living in a constant-television environment (Saelens et al., 2002) were heavier television viewers than were non-Black children and children not exposed to constant television. This study shows that television viewing also began earlier for these children. In addition, children whose parents had positive beliefs about television watched television earlier and more than did children whose parents had less positive beliefs.

Structural equation models emphasizing the sociodemographic, family, and child processes that underlie viewing did not predict much variance in the age of first television use, although they did a better job of predicting the amount of time children spent watching television. Most of the variation in how early and how much children used media is explained by factors other than those in the model. The processes depicted in the models tell us much about the dynamics underlying television use in families with young children, however.

Different aspects of socioeconomic status (i.e., income and parental education) predicted different features of the family television ecology, highlighting the importance of considering the unique contribution of income and education when

examining children's media use. Income was primarily associated with availability and pervasiveness of television in the home: More affluent homes had more television sets but a less pervasive television environment, suggesting that parents with higher incomes could afford multiple sets, but they are also likely to be able to provide the family with opportunities for activities other than television viewing, consequently creating home where the television is less pervasive.

Parental education was related to the regulation of television; this relation was not mediated by parents' attitudes toward television, indicating that other mechanisms (e.g., parenting skills) may mediate this link. Parental education also had a direct association with on how early and how much children watched television: Compared with children whose parents had less education, children of more highly educated parents watched television at a younger age but spent less time viewing. What underlies these relations is unclear; children of more highly educated parents may watch television earlier because they tend to watch educational programs. Compared with commercial programs, however, educational shows constitute a small portion of the available programming, which may explain why they also spend less time viewing. The inclusion of information about content would help to untangle these relations.

The findings from this study offered some insight as to what might constitute the home television ecology for young children, and how its structural (access and pervasiveness), attitudinal (beliefs about television), and behavioral (regulation)

components are interrelated. Apart from income and education, much of the family ecology of television use was predicted by parental beliefs about television. Results were consistent with the proposal that beliefs were precursors to multiple facets of family processes associated with when and how much children watched television. Positive beliefs about television was related to an absence of rules about viewing, increased availability of television in the home, and a more pervasive television environment. What predicts beliefs is unknown; they were not a function of education or income. Parental beliefs did not have a direct relation with how early children watched television, but it was directly linked to how much television children watched, suggesting that parents with positive beliefs may encourage more viewing, but not necessarily early viewing.

Rule setting, on the other hand, was directly related to how early children watched television but not how much television they watched. This was contrary to earlier studies documenting negative associations between regulation and viewing (Desmond et al., 1990; Kotler, 1999; Wiecha et al., 2001). While parents may report having rules about how much time their children could spend watching television, it is unclear how consistently the rules were enforced. Enforcement may have a greater bearing on viewing than the mere presence of rules. Having rules may be indicative of a more restrictive parenting style, which may contribute to viewing at a later age; rule setting, however, may not be the most effective way of regulating viewing, which may explain why it was not related to time spent watching television. Perhaps other forms

of mediation (e.g., coviewing, encouraging alternative activities) are more effectual than rule setting.

Exposure to a pervasive television environment was related to how early and how much children watched television. That it was related to children's viewing is not surprising, but that it was the construct most strongly and consistently associated with viewing—more so than regulation or socioeconomic variables—is notable. Findings did not suggest that a pervasive television environment was caused by children's viewing, nor was the relation between the two reciprocal. This is consistent with previous research showing that children's viewing is in large part determined by the viewing choices made by their parents, not the other way around (St. Peters et al., 1991). A pervasive television environment seems to characterize a broader family culture that is permissive or encouraging of television use, and features of such a culture includes a combination of positive beliefs about television's ability to help children's learning, an absence of rules about television use, and ready access.

The pervasiveness of television is analogous to background television described by researchers (Anderson & Evans, 2001; Anderson & Pempek, in press). While the data did not contain information about the content of programs that were showing when the television was in the background, it is likely that they were often not child-oriented programs: Researchers have found that infants and toddlers were exposed to adult-oriented programs (e.g., comedies, news, dramas) more than half the time when they were in the presence of television (Schmitt, 2001), and that even when

preschoolers were coviewing television with their parents, they were more likely to be subjected to their parents' program preferences than their own (St. Peters et al., 1991). A pervasive television environment can potentially increase children's television viewing, as well as the likelihood of exposure to adult-oriented programs, and such an environment can have long-term repercussions for children's media use. The youngest children in this sample were actually exposed to more constant-television than were older children, and given the research that suggests that inanimate ambient noise may interfere with infants' cognitive development (Wachs, 1986), more research is needed to better understand the antecedents and consequences of growing up in a home environment in which television saturates everyday life.

How early and how much children watched television were associated with a similar set of predictors. The sociodemographic and family contexts—but not child characteristics—that surround children's viewing have a bearing on these dual aspects of media use. Researchers have found the amount of television viewing to be stable over time (Anderson et al., 2001; Certain & Kahn, 2002; Huston et al., 1990; Tangney & Feshbach, 1988), but how early children started viewing was unrelated to how much they watched. To better address whether early media use sets the stage for heavy use, it would be necessary to know the amount of time children spent with media when they first started using them. On its own, early use may not set the stage for heavy use, but perhaps a combination of heavy use that begins early will be more predictive

of heavy use later on than either heavy use that begins late, or light use that begins early.

Computer Use

Signs of the digital divide are apparent when examining the onset of computer use among young children. In particular, socioeconomic status and ethnicity were associated with the timing of first use, and the results were consistent with previous findings pertaining to computer use and access (e.g., Becker, 2000; Dutton et al., 1987; Newburger, 2001; Rathburn et al., 2003). Children whose parents had more education were more likely to use a computer during every year studied, as did those who had more computers at home. Hispanic children were particularly disadvantaged when it came to computer use: The prevalence and incidence of use were very low compared to children of other ethnicities. In addition, the incidence and prevalence of use were higher among children whose parents had positive beliefs about computers than among those whose parents had less positive beliefs. Whether early computer use confers an advantage in the mastery of technological literacy remains an open question. While this study did not find early computer use to be related to heavier use, the specific skills children learn or the comfort level they feel with computers—rather than the amount of use—may be linked to how early they started using them.

Compared with television viewing, the processes surrounding computer use appear less complex. Sociodemographic factors and various aspects of the family media ecology were implicated in television viewing, whereas computer use was

largely predicted by socioeconomic status and access. The path models indicated that parent education and the availability of computers in the home were the main predictors of how early computer use began. Parental beliefs, regulation, and child gender did not play a role in predicting the age at which children used computers.

The amount of time children spent using computers was related to income and availability, but when ethnic group differences were considered, different causal processes were uncovered. Among Black and Hispanic children, parental beliefs emerged as a predictor of computer access in addition to income. Among White children, parental beliefs about computers was the sole predictor of use; beliefs did not operate through the provision of access as it did with Black and Hispanic children. The model accounted for appreciably more variance in Black and Hispanic children's use than it did for White children. This suggests that factors related to socioeconomic address (i.e., income and access) were more salient in accounting for use for Black and Hispanic children than for White children.

Among the multigroup analyses conducted, the only group difference to emerge was that between ethnic groups on computer use. The absence of age-group differences in the models tested was surprising, given the developmental differences that exist within the 6-month to 6-year age range. The process underlying how early and how much children use media operated in the same way for young children regardless of whether they were infants, toddlers, or preschoolers. Child characteristics (age and gender) did not moderate such processes or directly predict

media use. For young children, then, the processes predicting media use were more strongly associated with the media ecology of the home than with the individual characteristics of the child. The family is indeed the principal part of the process that shapes media use for young children.

Young children's media use is enmeshed in the family system and much of the media to which they are exposed are a result of choices or behaviors—intentional and unintentional—of the adults in the family. Media are in turn an integral part of most adult family members' lives. Thus, policy recommendations regarding young children's media use—such as those made by the American Association of Pediatrics to limit children's screen time to less than 2 hours a day— that are made without considering the media ecology of the home are overlooking the importance of the contexts in which use is embedded.

Theoretical perspectives underlying the concept of media ecologies have yet to be fully developed. Ethnographic studies on families' television use suggest that television serves multiple purposes, both structural and relational. It is often used as a companion or to provide a constant stream of background noise that contributes to the overall social environment; it also helps to structure the day and facilitate communication (Lull, 1990). Interestingly, then, background television may not benefit young children, but its regular presence is likely a result of the many functions that it fulfils for some families.

Not all families use television in the same way, however. Family communication patterns have been found to distinguish how television is used (Chaffee, McLeod, & Atkin, 1971): Families that emphasize harmony (socio-oriented) watched more television overall (but less news) and more violent television, whereas families that value expression and discussion of ideas (concept oriented) used mass media for news rather than for escape (Chaffee et al., 1971). Socio-oriented families used television for social purposes; they were likely to consider television as a means of facilitating communication and as a basis for building interpersonal communication in the home. Parental modeling of program choices (especially news and entertainment programs) was particularly salient in these families, and family members were likely to adopt each other's television habits (Lull, 1990). By contrast, concept oriented families did not regard television as a useful social resource. Styles of family communication can thus be one way of differentiating ways in which families use television—and media in general—and consequently, the kind of media ecology that is created. Examining the ways in which media are knit into the fabric of family life and the ways in which family members use media as a resource—be it for social needs or other purposes—can be a useful approach to better conceptualize the notion of media ecologies.

Limitations of the Current Study

Several caveats regarding this study must be acknowledged. One limitation pertains to the problem of predicting a past outcome—the age of first use—using

variables from the current period. This entails the assumption that the variables used as predictors were stable between the time when the child first used the medium and the time when the data were collected. Whether this supposition is accurate cannot be verified without information on variables from the former period.

Another limitation concerns the assumptions associated with event history analysis: The models tested were based on assumptions of linearity (i.e., effects of predictors are linear) and proportionality (i.e., each predictor has an identical effect in every period under study (Singer & Willet, 2003). While these assumptions can be tested by including nonlinear forms (e.g., quadratic and cubic terms) and by including interactions of predictors with time, these procedures were beyond the scope of the present study.

Many constructs that might affect children's media use were incorporated in the SEMs but the models did not account for much variation in the dependent variables of interest. Other variables that might be influential in the processes—but were not available in these data—may include the quality of the home environment, the availability of alternative activities other than media use, parental attitudes toward non-media activities, and siblings' media use. It is also important to highlight the exploratory nature of the models tested; their validity cannot be properly evaluated without cross-validation on new data.

A final reminder is that the child characteristics examined in this study were limited to age, gender, and being an only child. The findings that child characteristics

were not predictive of media use must be restricted to the characteristics under investigation. Other child-level factors (e.g., preferences, choices, temperament, and behaviors) could certainly be important in predicting media use or in moderating the processes described in this study.

Conclusions and Future Directions

The sociodemographic and family dynamics surrounding television viewing are considerably more complicated than for computer use. Because the computer is a relatively new and costly medium, socioeconomic status and access are the primary determinants of use. Television, on the other hand, has been firmly embedded into family life, and complex family processes surround it. Computers have yet to be entrenched in households in such a way. At present, the two media have different characteristics, serve different functions for individuals and families, and invoke different attitudes, but as media platforms continue to merge and multipurpose devices continue to be developed, the lines between television and computers may become increasingly blurred. It is unclear how these media will evolve and consequently, how they will become folded into family life in the future.

Earlier generations of children grew up in a media landscape that was simpler than the landscape of today. While books used to be young children's introduction to mass media (Schramm et al., 1961), the pathways of media use may be very different for the current generation. With new media products being targeted at the youngest users, electronic media may constitute the first media that most children encounter.

Its use may begin increasingly early, and the resulting implications for children's physical, emotional, social, and cognitive development will continue to fuel debate and controversy. The importance of longitudinal studies that include samples of very young children will become increasingly important in order to fully understand the roles and impacts of media in young children's lives, and to integrate research in a developmental framework.

While the examination of overall use is a necessary first step into gaining an insight into media in young children's lives, future research on young children's media use must also focus on what content children use or which activities they engage in when using media, particularly newer forms of interactive media. Content or activities must then be linked to specific outcomes (social, cognitive, and physical). For instance, a media diet consisting primarily of educational content will likely lead to social outcomes that are divergent from one that contains mainly violent or action content. Such an examination should include careful analyses of what content is in the foreground and what is in the background of children's media environment, which will allow researchers to better assess their unique effects.

Young children's exposure to background media also complicates the issue of measurement. Other than video-taping children's use, researchers have yet to device reliable alternatives for measuring media use. Perhaps the notion of media environments or media ecologies—the system of structures, technologies, and behaviors that surround media-- may be a more useful approach to understanding

media use in the current milieu than the existing ways of conceptualizing media use (i.e., examining the use of a single medium; Rutenbeck, 2004). Its application may prove to be challenging, however. The results from this study may help to inform researchers as to what might characterize the media ecology for young children. This ecology will no doubt expand and become increasingly complicated as children grow and enter into other contexts that include schools and peer groups.

Table 21

Correlations among All Variables in the Television Sample

	Child age (1)	Parent educ. (2)	Income (3)	Gender (4)	Black (5)	Hisp. (6)	White (7)	Beliefs: TV (8)	Num. of TVs (9)	TV in bedrm (10)	Cons. TV (11)	TV Meals (12)	Rules: TV (13)	Min. TV[a] (14)	Age first use (15)
1.	--														
2.	.031	--													
3.	.137**	.507**	--												
4.	-.008	.016	.015	--											
5.	-.038	-.030	-.165**	.000	--										
6.	-.003	-.249**	-.207**	-.022	-.187*	--									
7.	.032	.221**	.292**	.017	-.630**	-.645**	--								
8.	.004	-.032	.009	.101**	-.043	-.001	.034	--							
9.	.097**	.070	.224**	.039	.147**	-.065	-.063	.150**	--						
10.	.153**	-.154**	-.098**	-.014	.197**	.082	-.218**	.100**	.399**	--					

Table continues

	Child age (1)	Parent educ. (2)	Income (3)	Gender (4)	Black (5)	Hisp. (6)	White (7)	Beliefs: TV (8)	Num. of TVs (9)	TV in bedrm (10)	Cons. TV (11)	TV Meals (12)	Rules: TV (13)	Min. TV[a] (14)	Age first use (15)
11.	-.119*	-.136**	-.112**	.030	.122*	.004	-.098**	.125**	.252**	.216**	--				
12.	-.067	-.144**	-.171**	.051	.171**	-.035	-.105**	.147**	.165**	.235**	.543**	--			
13.	.124**	.154**	.057	-.029	.051	-.023	-.022	-.090**	-.011	-.022	-.224**	-.273**	--		
14.	.020	-.166**	-.057	-.010	.072	.071	-.112**	.183**	.097**	.062	.245**	.198**	-.163**	--	
15.	.438**	-.081*	.015	-.006	-.056	.031	.019	-.064	.015	.095**	-.119**	-.086*	.118**	-.058	--

Note. $N = 750$

[a] Minutes have been log-transformed

** $p < .01$, ** $p < .05$

Table 22

Correlations among All Variables in the Television Sample for Children ages 0 to 2 and 3 to 4

	Parent educ. (1)	Income (2)	Gender: Girl (3)	Black (4)	Hisp. (5)	White (6)	Beliefs: TV (7)	Num. of TVs (8)	TV in bedrm (9)	Cons. TV (10)	TV Meals (11)	Rules: TV (12)	Min. TV[a] (13)	Age first use (14)
1.	--	.584**	.091	-.098	-.160*	.204**	-.063	.083	-.179**	-.111	.130**	.146**	-.243**	-.086
2.	.458**	--	-.022	-.259**	-.114	.296**	-.055	.186**	-.154*	-.010	-.201**	.069	-.111	-.028
3.	.006	.123*	--	.003	-.159**	.122*	.107	.005	-.014	.051	.130*	-.044	.031	.007
4.	-.043	-.102	-.018	--	-.203**	-.638**	-.085	.062	.234**	.034	.107	.116	.076	.051
5.	-.288**	-.235**	.012	-.185**	--	-.624**	-.028	-.056	.151*	.041	.006	-.085	.117	-.039
6.	.261**	.265**	.004	-.627**	-.649**	--	.090	-.006	-.306**	-.059	-.090	-.026	-.152**	-.010
7.	.023	.093	.202**	.002	-.010	.007	--	.028	.040	.082	.140*	-.069	.209**	-.084
8.	.090	.240**	.106	.189**	-.074	-.087	.268**	--	.306**	.221**	.015	.091	.101	.016
9.	-.055	-.080	-.031	.209**	-.088	-.092	.070	.398**	--	.226**	.143*	.078	.185**	-.010
10.	-.189**	-.181**	.008	.159*	-.006	-.118	.128*	.206**	.161**	--	.477**	-.184*	.291	-.153**

Table continues

	Parent educ. (1)	Income (2)	Gender: Girl (3)	Black (4)	Hisp. (5)	White (6)	Beliefs: TV (7)	Num. of TVs (8)	TV in bedrm (9)	Cons. TV (10)	TV Meals (11)	Rules: TV (12)	Min. TV[a] (13)	Age first use (14)
11.	-.233**	-.186**	-.004	.215**	-.041	-.134*	.105	.196**	.209**	.568**	--	-.232**	.287**	-.090
12.	.190**	.043	.010	.087	-.023	-.049	-.104	-.085	-.088	-.269**	-.261**	--	-.178**	.106
13.	-.150*	-.038	-.019	.022	.076	-.077	.178**	.039	-.032	.072	.122*	-.196**	--	-.084
14.	-.046	-.081	.015	-.073	.013	.046	-.149**	-.045	.019	-.032	-.177	.064	-.161*	--

Note. Correlations for 0- to 2-year-olds (n = 254) are above the diagonal; correlations for 3- to 4-year-olds (n = 263) are below the diagonal.

[a] Minutes have been log-transformed

** $p < .01$, ** $p < .05$

Table 23

Correlations among All Variables in the Television Sample for Children Ages 5 to 6

	Parent educ. (1)	Income (2)	Gender (3)	Black (4)	Hisp. (5)	White (6)	Beliefs: TV (7)	Num. of TVs (8)	TV in bedrm (9)	Cons. TV (10)	TV Meals (11)	Rules: TV (12)	Min. TV[a] (13)	Age first use (14)
1.	--													
2.	.457**	--												
3.	-.052	-.048	--											
4.	.072	-.100	.016	--										
5.	-.310**	-.299**	.094	-.170**	--									
6.	.192**	.314**	-.086	-.621**	-.667**	--								
7.	-.065	-.014	-.013	-.045	.039	.003	--							
8.	.018	.208**	.005	.213**	-.062	-.111	.142*	--						
9.	-.263**	-.142**	.012	.175**	.207**	-.297**	.193*	.457**	--					
10.	-.109	-.138**	.026	.177**	-.031	-.109	.163*	.373**	.324**	--				

Table continues

	Parent educ. (1)	Income (2)	Gender (3)	Black (4)	Hisp. (5)	White (6)	Beliefs: TV (7)	Num. of TVs (8)	TV in bedrm (9)	Cons. TV (10)	TV Meals (11)	Rules: TV (12)	Min. TV[a] (13)	Age first use (14)
11.	-.060	-.108	.022	.194**	-.080	-.083	.195*	.307**	.399**	.578**	--			
12.	.105	-.012	-.050	-.062	.060	-.001	-.109	-.090	-.123	-.202**	-.328**	--		
13.	-.108	-.034	-.048	.128	.012	-.106	.155*	.151*	.028	.375**	.182**	-.123	--	
14.	-.196**	-.052	-.021	-.094	.125	-.028	.002	-.055	.088	-.099	.013	.072	.015	--

Note. $n = 233$

[a] Minutes have been log-transformed

** $p < .01$, ** $p < .05$

Table 24

Correlations among All Variables in the Television Sample for Black and Hispanic Children

	Child age (1)	Parent educ. (2)	Income (3)	Gender (4)	Beliefs: TV (5)	Num. of TVs (6)	TV in bedroom (7)	Constant TV (8)	TV Meals (9)	Rules: TV (10)	Minutes TV[a] (11)	Age of first use (12)
1.	--	.185*	.256**	-.028	.042	.250**	.141	.051	.040	-.011	.089	.389**
2.	-.129	--	.481**	.010	-.027	.129	-.100	-.104	-.099	.-047	-.152	-.016
3.	-.011	.385**	--	.071	-.075	.378**	.098	.047	-.078	.063	.052	.100
4.	.250**	-.004	-.070	--	.258**	-.114	.024	-.268**	-.075	-.116	-.042	-.011
5.	.042	.086	.094	-.114	--	.125	.090	.128	.209*	-.192*	.178	.001
6.	.026	.181*	.182*	.022	.184**	--	.311**	.359**	.140	.053	.050	.115
7.	.184*	.038	-.074	-.073	.073	.286**	--	.369**	.259**	-.134	.028	.090
8.	-.269**	.013	-.028	.087	.112	.183*	-.037	--	.601**	-.114	.218*	-.188**
9.	-.197*	.044	.007	.063	.123	-.166	-.098	.584**	--	-.240**	.210*	-.033
10.	.244**	.225*	-.009	.015	-.055	-.040	.070	-.311**	-.223*	--	-.025	.125

Table continues

	Child age (1)	Parent educ. (2)	Income (3)	Gender (4)	Beliefs: TV (5)	Num. of TVs (6)	TV in bedroom (7)	Constant TV (8)	TV Meals (9)	Rules: TV (10)	Minutes TV[a] (11)	Age of first use (12)
11.	-.114	-.130	.097	-.066	.074	.143	-.167	.247**	.080	-.231*	--	-.156
12.	.503**	-.227*	-.163	.193*	-.148	-.206*	.055	-.057	-.063	.095	-.044	--

Note. Correlations for Black children (n = 86) are above the diagonal; correlations for Hispanic children (n = 115) are below the diagonal.

[a] Minutes have been log-transformed

** $p < .01$, ** $p < .05$

Table 25

Correlations among All Variables in the Television Sample for White Children

	Child age (1)	Parent educ. (2)	Income (3)	Gender (4)	Beliefs: TV (5)	Num. of TVs (6)	TV in bedroom (7)	Constant TV (8)	TV Meals (9)	Rules: TV (10)	Minutes TV[a] (11)	Age of first use (12)
1.	--											
2.	.034	--										
3.	.136**	.500**	--									
4.	-.064	.015	.012	--								
5.	-.016	-.070	-.001	.113*	--							
6.	.087*	.025	.235**	.015	.159**	--						
7.	.168**	-.174**	-.068	.044	.128**	.437**	--					
8.	-.118**	-.173**	-.142**	.009	.137**	.222**	.208**	--				
9.	-.053	-.205**	-.209**	.047	.152**	.139**	.275**	.507**	--			
10.	.127**	.163**	.084	-.015	-.074	-.031	-.034	-.241**	-.312**	--		

Table continues

	Child age (1)	Parent educ. (2)	Income (3)	Gender (4)	Beliefs: TV (5)	Num. of TVs (6)	TV in bedroom (7)	Constant TV (8)	TV Meals (9)	Rules: TV (10)	Minutes TV[a] (11)	Age of first use (12)
11.	.040	-.152**	-.070	-.026	.214**	.090*	.088*	.239**	.209**	-.164**	--	
12.	.431**	-.049	.039	-.058	-.059	.068	.126**	-.114**	-.091*	.128**	-.043	--

Note. $n = 549$

[a] Minutes have been log-transformed

** $p < .01$, ** $p < .05$

Table 26

Correlations among All Variables in the Computer Sample

	Child age (1)	Parent education (2)	Income (3)	Gender (4)	Black/ Hispanic (5)	Beliefs: computer (6)	Number of computers (7)	Rules: computer (8)	Minutes: Computer[a] (9)	Age of first use (10)
1.	--									
2.	-.065	--								
3.	.053	.476**	--							
4.	-.046	-.108*	-.058	--						
5.	-.084	-.134**	-.299**	.045	--					
6.	-.033	-.054	-.003	.023	-.013	--				
7.	-.013	.251**	.330**	.009	-.004	.046	--			
8.	.006	-.043	-.042	-.037	.025	-.076	-.056	--		
9.	.047	-.064	-.063	-.076	.066	.088	.108*	.012	--	
10.	.643**	-.145**	-.048	.060	.013	-.040	-.155**	.051	.053	--

Note. $N = 411$; [a] Minutes have been log-transformed; ** $p < .01$, ** $p < .05$

Table 27

Correlations among All Variables in the Computer Sample for Children Ages 0 to2

	Parent education (1)	Income (2)	Gender (3)	Black/ Hispanic (4)	Beliefs: computer (5)	Number of computers (6)	Rules: computer (7)	Minutes: Computer[a] (8)	Age of first use (9)
1.	--								
2.	.747**	--							
3.	-.109	-.294**	--						
4.	-.435**	-.540**	.069	--					
5.	.124	.139	.163	-.254	--				
6.	.224	.407**	-.057	-.215	.066	--			
7.	.276	.067	-.123	.165	-.191	.167	--		
8.	-.022	.146	-.225	.021	.068	.206	.021	--	
9.	-.261	.025	-.031	-.034	.031	-.120	.032	.205	--

Note. $n = 52$; [a] Minutes have been log-transformed

** $p < .01$, ** $p < .05$

Table 28

Correlations among All Variables in the Computer Sample for Children Ages 3 to 4 and 5 to 6

	Parent education (1)	Income (2)	Gender (3)	Black/ Hispanic (4)	Beliefs: computer (5)	Number of computers (6)	Rules: computer (7)	Minutes: Computer[a] (8)	Age of first use (9)
1.	--	.429**	-.122	-.190*	.004	.311**	-.099	.018	-.034
2.	.445**	--	-.005	-.199*	-.124	.353**	-.108	-.036	-.028
3.	-.101	-.026	--	.004	-.020	.066	.033	.000	.012
4.	.001	-.143	.070	--	-.074	.037	.087	.020	.034
5.	-.134	.035	.021	.081	--	-.018	-.071	.068	-.095
6.	.215**	.301**	-.015	.030	.084	--	-.055	.058	-.155*
7.	-.080	-.024	-.077	-.078	-.057	-.120	--	-.044	.033
8.	-.134	-.149*	-.105	.132	.106	.131	.056	--	.059
9.	-.170*	-.173*	.191*	.134	-.008	-.215**	.078	-.023	--

Note. Correlations for children ages 3 to 4 (n = 171) are above the diagonal; correlations for children ages 5 to 6 (n = 188) are below the diagonal; [a] Minutes have been log-transformed; ** $p < .01$, ** $p < .05$

Table 29

Correlations among All Variables in the Computer Sample for Black and Hispanic, and White Children

	Child age (1)	Parent education (2)	Income (3)	Gender (4)	Beliefs: computer (5)	Number of computers (6)	Rules: computer (7)	Minutes: Computer[a] (8)	Age of first use (9)
1.	--	-.139	.215*	-.023	.173	.123	-.195	.148	.735**
2.	-.139*	--	.480**	-.169	.165	.415**	.080	.072	-.153
3.	-.033	.459**	--	.026	.166	.390**	.029	-.062	-.044
4.	-.048	-.083	-.078	--	-.004	-.085	-.164	-.181	.044
5.	-.087	-.113*	-.065	.031	--	.275**	-.109	-.014	-.053
6.	-.049	.209**	.325**	-.076	-.009	--	-.011	.339**	-.156
7.	.066	-.074	-.062	-.073	-.067	-.068	--	.066	-.076
8.	.023	-.095	-.045	-.048	.119*	.042	-.007	--	.002
9.	.619**	-.142*	-.048	.065	-.037	-.155**	.089	.069	--

Note. Correlations for Black and Hispanic children ($n = 78$) are above the diagonal; correlations for White children ($n = 333$) are below the diagonal; [a] Minutes have been log-transformed; ** $p < .01$, ** $p < .05$

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